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LETTER OF TRANSMITTAL

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Date: 6/20/02

Sauget Area 1

Dead Creek Final Remedy
Engineering Evaluation/Cost Analysis

The following items are:

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No. of Copies	Description
1	Engineering Evaluation/Cost Analysis,
1	Human Health Risk Assessment ✓
1	Ecological Risk Assessment
1	Data Validation Report
1	Database (Compact Disk)

The above items are submitted:

At your request For your review For your signature
 For your files For your action X your information

Comments:

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Sauget Area 1

Dead Creek Final Remedy
Engineering Evaluation/Cost Analysis

The following items are:

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No. of Copies	Description
3	Engineering Evaluation/Cost Analysis,
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Comments:

By: Bruce Yare

**Solutia, Inc.
St. Louis, Missouri**

**Sauget Area 1 -
Dead Creek Final Remedy
Creek Bottom Soil
Engineering Evaluation/Cost
Analysis**

**Volume II: Human Health
Risk Assessment**

Sauget and Cahokia, Illinois

**Submitted To:
USEPA Region 5, Chicago, Illinois**

**Submitted By:
Solutia Inc.
St. Louis, Missouri**

**ENSR International
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LIST OF ACRONYMS

AAF	Absorption Adjustment Factors
AOC	Administrative Order by Consent
ARAR	Applicable or Relevant and Appropriate Requirement
CADD	Chronic Average Daily Dose
CAS	Chemical Abstracts Service
COC	Constituent of Concern
COPC	Constituent of Potential Concern
CS	Creek Segment
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
DQL	Data Quality Level
EE/CA	Engineering Evaluation/Cost Analysis
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IEPA	Illinois Environmental Protection Agency
IRIS	Integrated Risk Information System
LADD	Lifetime Average Daily Dose
LMS	Linearized Multi-Stage
LOAEL	Lowest Observed Adverse Effect Level
MLE	Most Likely Exposure
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
SOW	Scope of Work
SSL	Soil Screening Level
SSP	Support Sampling Plan

LIST OF ACRONYMS (Cont'd)

SQL	Sample Quantitation Limit
SVOC	Semi-Volatile Organic Compound
TACO	Tiered Approach to Corrective Action Objectives
TCDD	Tetrachlorodibenzo-p-dioxin
TEF	Toxic Equivalence Factor
TEQ	Toxic Equivalence Concentration
TPH	Total Petroleum Hydrocarbons
UAO	Unilateral Administrative Order
UCL	Upper Confidence Limit
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compounds
WHO	World Health Organization

1.0 INTRODUCTION

This report presents the baseline human health risk assessment (HHRA) for creek bottom soils in Dead Creek Segments B-F and Site M, Sauget Area 1, located in Sauget and Cahokia, Illinois, and is presented as Volume II of the Dead Creek Final Remedy Engineering Evaluation/Cost Analysis (EE/CA). The environmental data used in this HHRA were collected from each creek segment after the sediment removal action was conducted under the unilateral administrative order (UAO).

The HHRA was conducted in accordance with the USEPA-approved Human Health Risk Assessment Workplan (HHRA Workplan) dated June 25, 1999 (including the August 6, 1999 revised pages), which was submitted as Volume 1B of the Support Sampling Plan (SSP) for Sauget Area 1 (Solutia, 1999). The HHRA Workplan was also provided as Appendix A of the USEPA-approved Human Health Risk Assessment for Sauget Area 1 (Solutia, 2001).

The HHRA was conducted using data from environmental samples collected from the creek and Site M. The study area is indicated in Figure 1-1 and described in more detail in Section 2. Validated laboratory analytical data are compiled Table 2-6 of Volume I of this EE/CA.

Baseline Risk Assessment

The purpose of the baseline HHRA is to evaluate potential human health effects of chronic exposures to constituents detected in samples of environmental media collected from the study area.

The HHRA was conducted to be consistent with USEPA guidance for conducting a risk assessment including, but not limited to, the following:

- Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Parts A and D) (USEPA, 1989a and 1998a).
- Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (USEPA, 1991a).
- USEPA Soil Screening Guidance: User's Guidance Manual, and Technical Background Document (USEPA, 1996a,b).
- Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. OSWER Directive 9285.6-03 (USEPA, 1991b).
- Exposure Factors Handbook (USEPA, 1997a).
- Land Use in CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04 (USEPA, 1995a).

In addition, elements of the Illinois Environmental Protection Agency (IEPA) Tiered Approach to Corrective Action Objectives (TACO) (IEPA, 1998) were used in the conduct of the HHRA.

The baseline HHRA has been conducted in accordance with the four-step paradigm for human health risk assessments developed by USEPA (USEPA, 1989a); these steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

Report Organization

A description of the site is presented in Section 2.0. The baseline HHRA is presented in Sections 3.0 through 6.0 of this report. Section 7.0 presents the summary and conclusions and Section 8.0 provides the references. A summary of the information presented in each section of the report follows.

- Section 2.0 – Site Characterization. This section discusses the site and its environs, describes source areas, potential migration pathways, and potentially impacted media.
- Section 3.0 – Data Evaluation and Hazard Identification. This section presents a summary of the site data for use in the HHRA, and the results of the process used for the selection of constituents of potential concern (COPCs) to be quantitatively evaluated in the baseline HHRA.
- Section 4.0 – Dose-Response Assessment. The dose-response assessment evaluates the relationship between the magnitude of exposure (dose) and the potential for occurrence of specific health effects (response) for each COPC. Both potential carcinogenic and noncarcinogenic effects are considered. This section presents the quantitative dose-response values used in the baseline HHRA. The most current USEPA verified dose-response values are used when available.
- Section 5.0 – Exposure Assessment. The purpose of the exposure assessment is to provide a quantitative estimate of the magnitude and frequency of potential exposure to COPCs by a receptor. This section presents the updated conceptual site model (CSM) originally presented in the HHRA Workplan. Potentially exposed individuals, and the pathways through which those individuals may be exposed to COPCs are identified based on the physical characteristics of the site, as well as the current and reasonably foreseeable future uses of the site and surrounding area. The extent of a receptor's exposure is estimated by constructing exposure scenarios that describe the potential pathways of exposure to COPCs

and the activities and behaviors of individuals that might lead to contact with COPCs in the environment.

- Section 6.0 – Risk Characterization. Risk characterization combines the results of the exposure assessment and the toxicity assessment to derive site-specific estimates of potentially carcinogenic and noncarcinogenic risks resulting from both current and reasonably foreseeable potential human exposures to COPCs. The results of the risk characterization are used to identify constituents of concern (COCs), which are a subset of those COPCs whose risks result in an exceedance of the target risk range of 1×10^{-6} to 1×10^{-4} for potential carcinogens and a target Hazard Index of one for noncarcinogens (that act on the same target organ), as defined in the Administrative Order by Consent Scope of Work (AOC SOW), USEPA guidance (USEPA, 1991a), and by IEPA (1998). The target risk levels used for the identification of COCs are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

“Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} , and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts.” and,

“The upper boundary of the risk range is not a discrete line at 1×10^{-4} , although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions.”

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

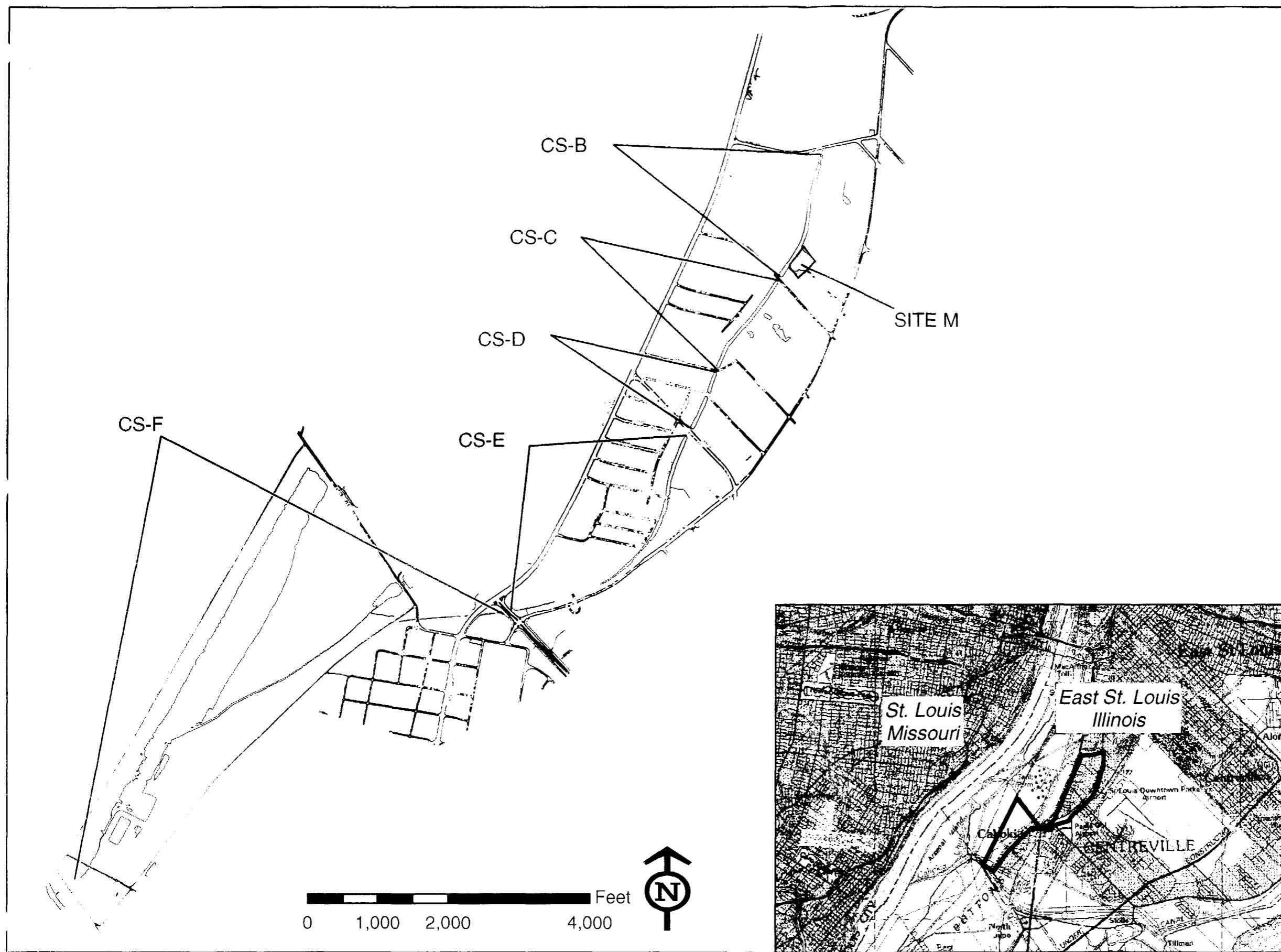
“The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [10^{-4}]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level.”

Within any of the steps of the risk evaluation process described above, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. The assumptions that introduce the greatest amount of uncertainty in this risk evaluation are discussed in Section 6.0.

- Section 7.0 – Summary and Conclusions. This section presents a summary of the results of the baseline HHRA.
- Section 8.0 – This section presents the references used in the text.

Tables and figures follow each section.

FIGURE 1-1
Sauget Area 1 Study Area



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2.0 SITE CHARACTERIZATION

This HHRA addresses data from creek bottom soil samples collected from Dead Creek and Site M. Specifically, this HHRA for Sauget Area 1 addresses creek bottom soil in the following areas:

- Site M
- Dead Creek Segments (CS): CS-B, CS-C, CS-D, CS-E, and CS-F

2.1 Study Area Description

Figure 1-1 presents the study area addressed by this HHRA.

Dead Creek is an intermittent urban stream that bisects Sauget Area 1, passing through areas of commercial land use, areas of open land, and areas of residential land use, and eventually discharges to Borrow Pit Lake and Prairie DuPont Creek. The Borrow Pit Lake was formed as the result of the excavation of borrow material in the mid-1950's for local construction, including the levy.

Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a CSM for human health was developed. The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors. The CSM is meant to be a "living" model that can be updated and modified as additional data become available.

The initial CSM for the site is presented in Figure 2-1 of the HHRA Workplan (Solutia, 1999). An updated CSM for the creek bottom soils is presented in Section 5.0, based on the data evaluation and COPC selection conducted in Section 3.0.

3.0 DATA EVALUATION AND HAZARD IDENTIFICATION

The purpose of the data evaluation and hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of these constituents identified as COPCs for quantitative evaluation in the risk assessment. This step of the risk assessment involves compiling and summarizing the data for the risk assessment, and selecting COPCs based on a series of screening steps.

3.1 Data Evaluation

The HHRA was conducted using validated data collected from Dead Creek and Site M after remediation activities were complete. Data used in the HHRA are presented in Table 2-6 of Volume I of this EE/CA.

3.1.1 Areas and Media

This risk assessment evaluates creek bottom soils in Dead Creek, including creek segments CS-B, CS-C, CS-D, CS-E, CS-F, and Site M.

Figure 3-1 shows the study area and the sample collection locations for creek bottom soil.

3.1.2 Analytes

The SSP identified the suites of analytes for each medium. For ease of discussion here, the analytes included in the risk assessment are identified as follows:

- Full suite of analytes – volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, mercury, cyanide, polychlorinated biphenyls (PCBs), pesticides, and herbicides;
- Dioxins – dioxins and furans.

All analytical data collected in support of the SSP were compiled and tabulated in a database for statistical analysis. These data are presented in Table 2-6 of Volume I of this EE/CA.

3.1.3 Summary Statistics

The data for each area were summarized for use in the risk assessment. The following guidance documents were used to develop the summary statistics:

- Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual, Part A (U.S. EPA, 1989a).
- Supplemental Guidance to RAGS: Calculating the Concentration Term (U.S. EPA, 1992a).

The steps used to summarize the data by area for use in identifying COPCs in the screening process presented in this section are discussed here. The additional steps used to summarize the data for identifying exposure point concentrations (EPCs) are presented in Section 5.0.

The steps used to summarize the data by area and medium are as follows:

Treatment of Duplicates: Data for samples and their duplicates were averaged before summary statistics were calculated, such that a sample and its duplicate were treated as one sample for calculation of summary statistics (including maximum detection and frequency of detection).

Treatment of Non-Detects:

- Summary statistics were not calculated for constituents that were not detected in a particular area.
- Where constituents were detected in some samples and not in others in a particular area/medium, $\frac{1}{2}$ the reported sample quantitation limit (SQL) was used as a proxy concentration for the samples reported as nondetect (USEPA, 1989b).
- For all non-detects for which $\frac{1}{2}$ the SQL was calculated, $\frac{1}{2}$ the SQL was compared to the maximum detected concentration for that area. Where $\frac{1}{2}$ the SQL was greater than the maximum detected concentration in a particular area/medium, the SQL value was not used in the calculation of summary statistics for that constituent in that area and medium (USEPA, 1989a).

Frequency of Detection: The frequency of detection is reported as three numbers indicating the number of samples reported as detected for a specific constituent, the number of samples used to calculate statistics (reflecting the treatment of non-detects described above) and the total number of samples analyzed.

Minimum Detected Concentration: This is the minimum detected concentration for each constituent/area/medium combination, after duplicates have been averaged.

Maximum Detected Concentration: This is the maximum detected concentration for each constituent/area/medium combination, after duplicates have been averaged.

Average Concentration: This is the arithmetic mean concentration for each constituent/area/medium combination, after duplicates have been averaged and non-detects have been evaluated.

Data for all samples, as presented in Table 2-6 of Volume I of this EE/CA, were used in this evaluation. Attachment A presents the summary statistics by area and medium. Creek Bottom Soil Sample Collection and Data Evaluation

Creek bottom soil sample locations included in the risk assessment are identified on Figure 3-1, and Attachment A presents the summary statistics. Each creek segment and Site M are being evaluated as separate areas in the risk assessment. Samples were analyzed for the full suite of Appendix IX analytes, dioxins and furans.

3.2 Methodology for Selection of Constituents of Potential Concern

COPCs are a subset of the complete list of constituents detected in site media that are carried through the quantitative risk assessment process. Selection of COPCs focuses the analysis on the most likely risk “drivers.” As stated in USEPA guidance (USEPA, 1993a):

“Most risk assessments are dominated by a few compounds and a few routes of exposure. Inclusion of all detected compounds at a site in the risk assessment has minimal influence on the total risk. Moreover, quantitative risk calculations using data from environmental media that may contain compounds present at concentrations too low to adversely affect public health have no effect on the overall risk estimate for the site. The use of a toxicity screen allows the risk assessment to focus on the compounds and media that may make significant contributions to overall risk.”

Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status. Each of these evaluation steps is called a “screening step.” Risk calculations are conducted using the COPCs identified in these steps.

The steps used to identify COPCs are presented below.

3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status

Per the HHRA Workplan (Solutia, 1999), a frequency of detection screen was conducted on creek bottom soils. According to this screening step, constituents that are detected in fewer than 5% of samples, provided 20 samples are available, would not be included as COPCs, though some of these constituents would be retained as COPCs based on professional judgment, considering factors such as the presence of a hotspot. Based on the summary statistics (Attachment A) several constituents meet the criteria of low frequency of detection. These constituents were not eliminated from the risk assessment based on frequency of detection, but rather were evaluated through the rest of the COPC selection process to ensure that no hotspots exist. All but one of these constituents (4-nitroaniline in CS-B) were eliminated from further evaluation based on the toxicity screen described in Section 3.2.3. Therefore, 4-nitroaniline was retained for further evaluation in CS-B. In addition, essential nutrients (i.e., calcium, iron, magnesium, sodium and potassium) were not included as COPCs per the HHRA Workplan and USEPA guidance (Solutia, 1999, and USEPA, 1989a).

3.2.2 Comparison to Background

Background samples were collected in the vicinity of the site to provide information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons were conducted for creek bottom soil using site-specific background data and background concentrations.

Four creek sediment samples were collected from reference locations as part of the original SSP (Solutia, 1999), as there are no upgradient locations in Dead Creek outside of the study area.

The procedure for determining whether a constituent concentration is consistent with background follows that developed by USEPA Region 4 (USEPA, 2000a) and presented in the HHRA Workplan (Solutia, 1999). Maximum detected concentrations of constituents in environmental media at the site were compared to two times the arithmetic mean site-specific background concentration. USEPA Region 4 states that although RAGS (USEPA, 1989a) allows the use of statistics in data evaluation, statistics may not be sufficiently conservative at this stage of the risk evaluation; and in most cases, there are not a sufficient number of samples for conducting a statistical analysis. Therefore, if maximum concentrations of inorganic constituents in an area are found to be less than two times the average background concentrations, then those constituents are eliminated from quantitative evaluation in the risk assessment. Constituents whose maximum detected concentrations are above the defined background levels and not identified as an essential nutrient were retained for evaluation in the next step of the hazard identification process (Toxicity Screen).

The calculation of background concentrations is presented in Attachment B. It should be noted that arsenic in Creek Segment C was the only constituent eliminated as a COPC based solely on the background screening step.

3.2.3 Toxicity Screen

A toxicity screen was performed in accordance with USEPA Region 5 guidance (USEPA, 1998b) and IEPA regulations (IEPA, 1998).

3.2.3.1 Sources of Screening Criteria

USEPA Region 5 guidance identifies the following three sources as appropriate screening levels for soil, in order of preference:

- 1) Most recent generic soil screening levels (SSLs) developed and presented in Appendix A of the Soil Screening Guidance (USEPA, 1996b). The SSLs are based on ingestion and inhalation (direct contact) and soil-to-groundwater exposure pathways for a residential scenario.
- 2) Site-specific SSLs derived using the methodology outlined in the above reference.
- 3) Most recent USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 2000b).

The IEPA TACO program (IEPA, 1998) is very similar to that outlined in the SSL guidance (USEPA, 1996a) in that it provides Tier I criteria based on direct contact (ingestion and inhalation) and the soil-to-groundwater pathway. In fact, the TACO Tier I criteria have been developed based on the USEPA SSL guidance. However, the TACO Tier I criteria are more comprehensive because values are provided for a longer list of constituents, and Tier I criteria are available for both residential and industrial scenarios.

Therefore, IEPA TACO Tier I criteria were used for the identification of COPCs for creek bottom soil for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria (IEPA, 1998) were not available, structural similarity was used to assign a surrogate TACO Tier 1 criterion, and where this was not possible USEPA Region 9 PRGs (USEPA, 2000b) were used. The screening values are presented in Attachment C. It should be noted that the TACO Tier 1 criteria are being used here strictly as screening values; they are not considered either by USEPA or IEPA to be an "applicable or relevant and appropriate requirement" (ARAR) under the National Contingency Plan (NCP) (USEPA, 1990).

Residential values were used to identify COPCs for creek bottom soils. Region 9 PRGs were used as screening criteria for constituents detected in creek bottom soil which lack TACO Tier I criteria.

The TACO program also provides screening criteria for the groundwater ingestion component of the soil to groundwater pathway. These latter values conservatively address leaching of constituents from soils to underlying groundwater. These values are not applicable to creek bottom soils and were, therefore, not employed in this risk assessment.

The toxicity criteria available at the time of the HHRA Workplan (Solutia, 1999) preparation were used to develop data quality levels (DQLs), which were used to identify appropriate practical quantitation limits (PQLs) for laboratory methods for the analytical program addressed in the Quality Assurance Project Plans (QAPPs) for the site (see Volumes 2B and 3B of the SSP).

As noted in the HHRA Workplan, the PRGs are periodically updated by USEPA. The most current criteria available at the time of the screening were used in the selection of COPCs. These are the Region 9 PRGs dated November 1, 2000. The screening was conducted in May, 2002.

The as-published sources of screening criteria are presented in the HHRA Workplan Appendices. The TACO Tier I values are presented in Solutia, 2001. The PRGs presented in the HHRA workplan have been superceded by the November 1, 2000 version, which is available at <http://www.epa.gov/region09/waste/sfund/prg/index.html>.

Appendix C presents the specific screening values used for the creek bottom soil – direct contact screen.

3.2.3.2 Screening Methodology

Constituents in an area with maximum concentrations less than or equal to the toxicity screening criteria were not included as COPCs. Where no COPCs are identified for an area, that area is not evaluated quantitatively in the HHRA.

3.3 Hazard Identification

This section presents the results of the creek bottom soil COPC screening process.

Maximum constituent concentrations in creek bottom soil for Dead Creek Segments B-F and Site M were compared to residential soil screening values for direct contact, per the HHRA Workplan (Solutia, 1999). The screening table is presented in Attachment D.

The selected COPCs are indicated for each Creek Segment as well as Site M in Table 3-1. A total of sixteen compounds were selected as COPCs, including arsenic, copper, nickel, polycyclic aromatic hydrocarbons (PAHs), PCBs, dioxin, and several semi-volatile organic compounds. Note that not

every constituent is selected as a COPC in each area. The specific COPCs selected for each area are marked with an "X" in Table 3-1.

TABLE 3-1
CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Constituent	CAS	Area					SITE M
		Creek Segment B	Creek Segment D	Creek Segment E	Creek Segment F		
1,4-Dichlorobenzene	106-46-7	X					X
4-Nitroaniline	100-01-6	X					
Arsenic	7440-38-2	X	X	X	X		X
Benzo(a)anthracene	56-55-3	X					
Benzo(a)pyrene	50-32-8	X	X	X	X		X
Benzo(b)fluoranthene	205-99-2	X					
Bis(2-ethylhexyl)phthalate	117-81-7	X					
Copper	7440-50-8	X		X			X
Dibenzo(a,h)anthracene	53-70-3	X		X			X
Dieldrin	60-57-1	X	X				
Heptachlor	76-44-8						X
Heptachlor epoxide	1024-57-3	X					X
Pentachlorophenol	87-86-5	X					
2,3,7,8-TCDD TEQ	1746-01-6	X					X
Total PCBs	1336-36-3	X	X	X			X
Total:		14	4	5	2		9

Notes:

CAS - Chemical Abstracts Service.

PCB - Polychlorinated Biphenyl.

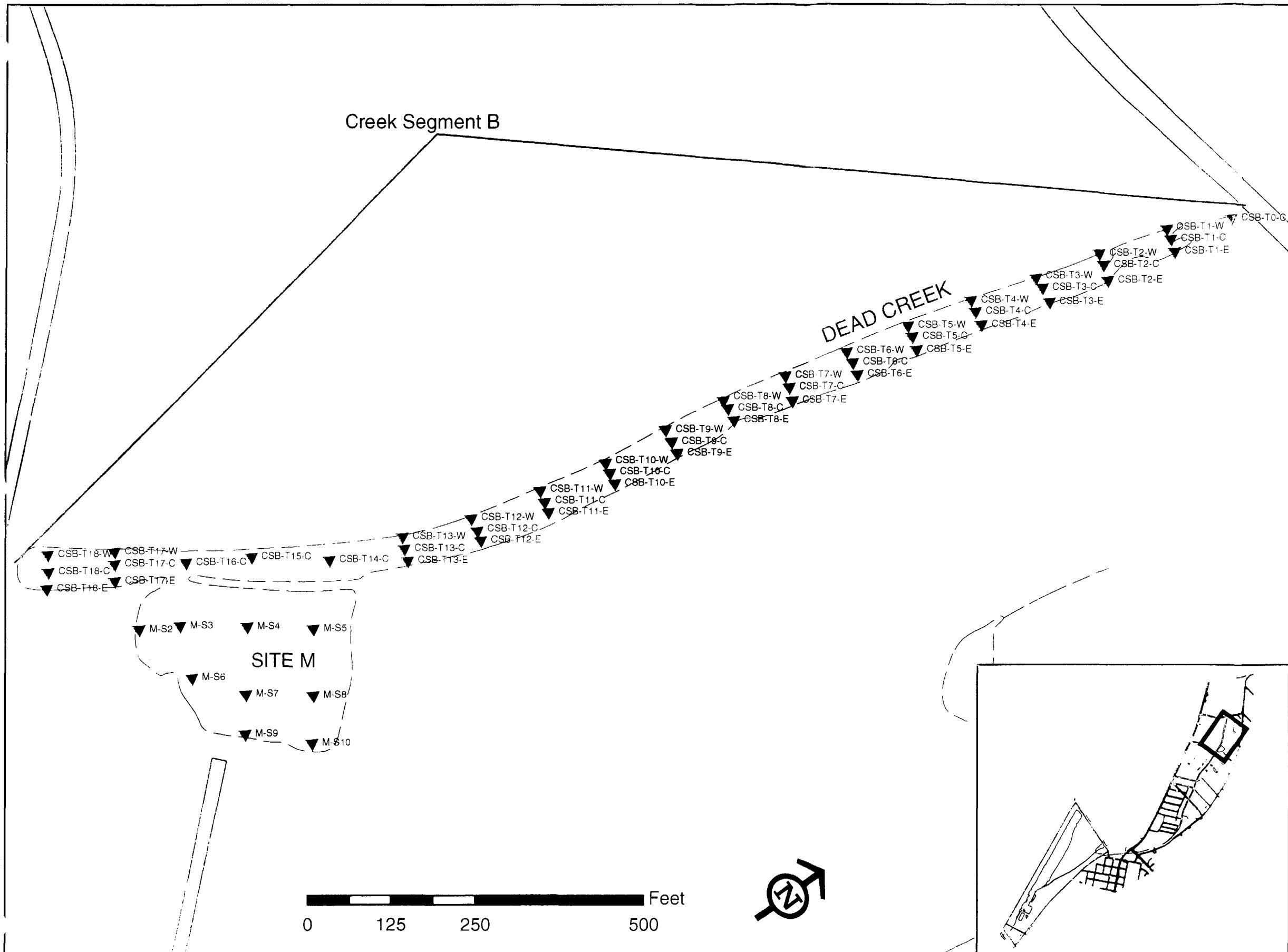
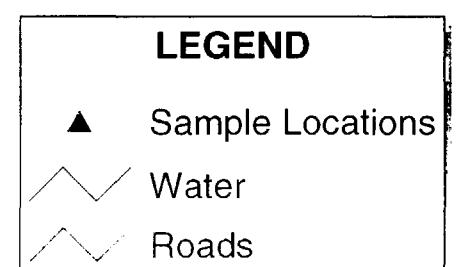
TCDD-TEQ - Total 2,3,7,8-tetrochloro-dibenzo-p-dioxin Toxicity Equivalents (calculated using Toxicity Equivalency Factors provided by Van den Berg et al., 1998).

X - Constituent of potential concern in this area.

Sauget Area 1
Creek Bottom Soils
Human Health Risk Assessment

FIGURE 3-1
Sauget Area 1
Creek Bottom Soils
Sample Locations

Sheet 1 of 3



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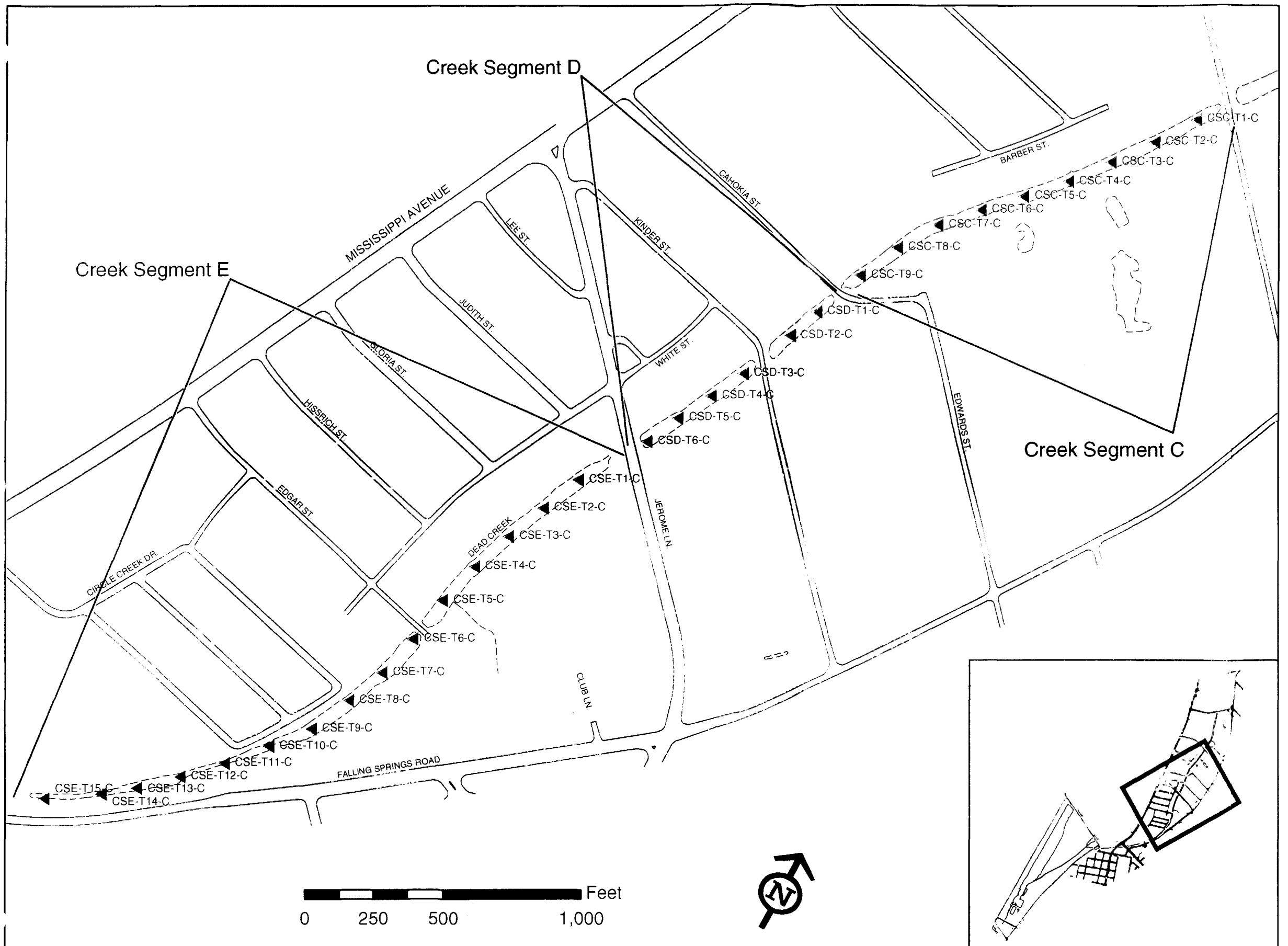
FIGURE 3-1 (cont.)

Sauget Area 1
Creek Bottom Soils
Sample Locations

Sheet 2 of 3

LEGEND

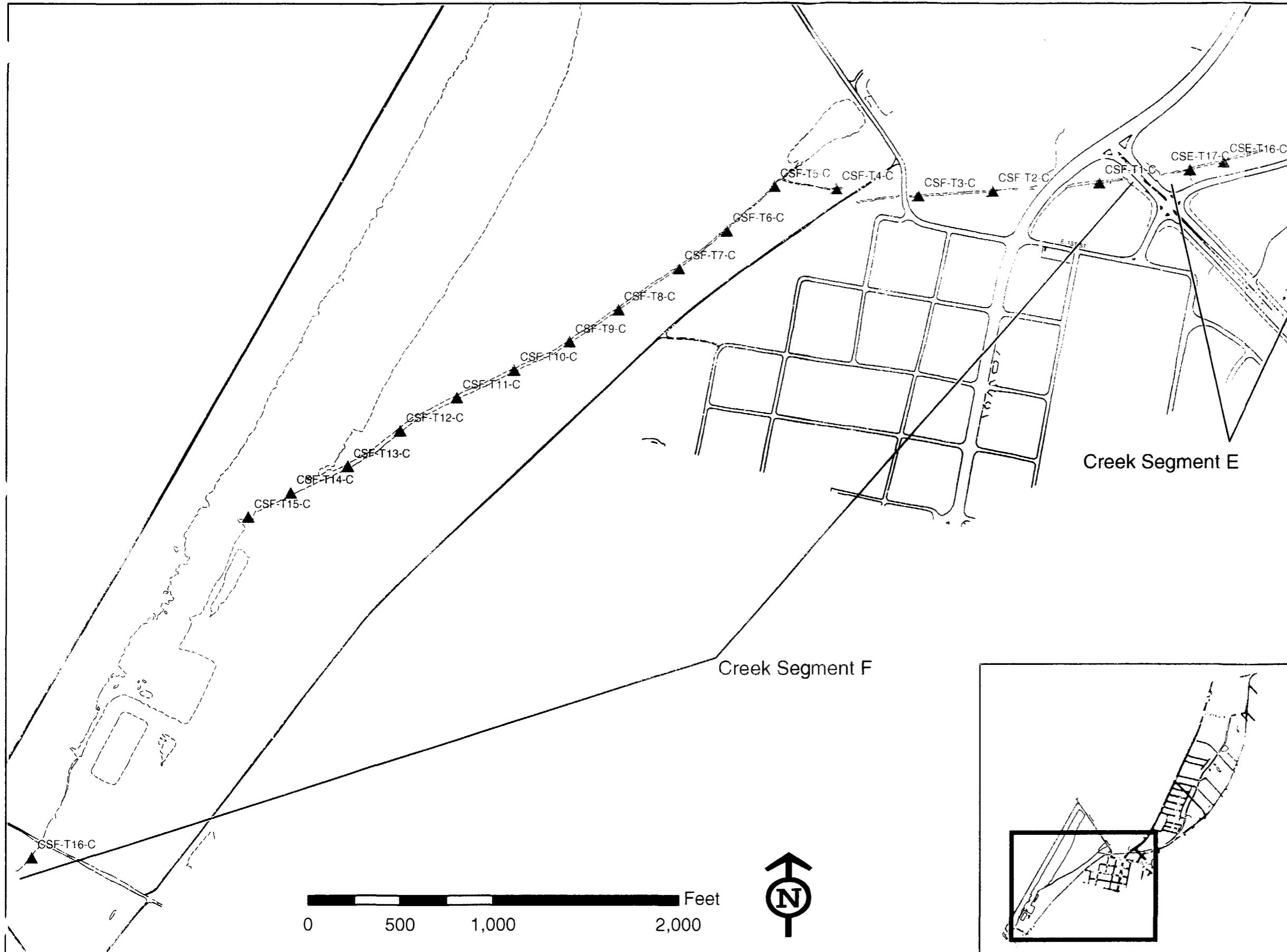
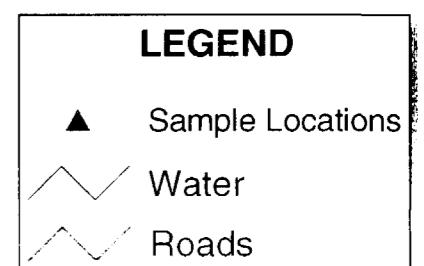
- ▲ Sample Locations
- ~~~~ Water
- ~~~~ Roads



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FIGURE 3-1 (cont.)
Sauget Area 1
Creek Bottom Soils
Sample Locations

Sheet 3 of 3



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4.0 DOSE-RESPONSE ASSESSMENT

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response) (USEPA, 1989a). Adverse effects are classified by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA for oral exposure and for exposure by inhalation. Oral toxicity values are also used to assess dermal exposures, with appropriate adjustments, because USEPA has not yet developed values for this route of exposure. Combining the results of the toxicity assessment with information on the magnitude of potential human exposure provides an estimate of potential risk.

Numerical toxicity values are generally obtained from USEPA databases/sources. The dose-response relationship is often determined from laboratory studies conducted under controlled conditions with laboratory animals. These laboratory studies are controlled to minimize responses due to confounding variables, and are conducted at relatively high dose levels to ensure that responses can be observed using as few animals as possible in the experiments. Mathematical models or uncertainty factors are used to extrapolate the relatively high doses administered to animals to predict potential human responses at dose levels far below those tested in animals. Humans are typically exposed to chemicals in the environment at levels much lower than those tested in animals. These low doses may be detoxified or rendered inactive by the myriad of protective mechanisms that are present in humans (Ames et al., 1987) and that may not function at the high dose levels used in animal experiments. Therefore, the results of these animal studies may only be of limited use in accurately predicting a dose-response relationship in humans. However, to be protective of human health, USEPA incorporates many conservative assumptions and safety factors when deriving numerical toxicity criteria from laboratory studies, as discussed below.

This section contains five subsections. Section 4.1 describes the sources of toxicity values. Section 4.2 describes USEPA's approach for developing noncarcinogenic toxicity values. Section 4.3 describes the toxicity values developed by USEPA for the evaluation of potential carcinogenic effects. Section 4.4 discusses PCB dose-response issues, and Section 4.5 discusses dioxin dose-response issues.

4.1 Sources of Toxicity Values

Sources of the published toxicity values in this risk assessment include USEPA's Integrated Risk Information System (IRIS) (USEPA, 2002a), the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b), and the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio.

The primary USEPA source of toxicity values is IRIS, an on-line computer database of toxicological information (USEPA, 2002a). The IRIS database is updated monthly to provide the most current USEPA verified toxicity values. As defined by the USEPA (1997b), a toxicity value is "Work Group-Verified" if all available information on the value has been examined by an Agency Work Group, the value has been calculated using current Work Group methodology, a unanimous consensus has been reached on the value by the Work Group, and the value appears on IRIS.

Another source of toxicity values is the USEPA HEAST (USEPA, 1997b). HEAST is published annually by the USEPA and provides a compilation of toxicity values available at the time of publishing. Because HEAST is no longer updated regularly, the toxicity values provided may not represent the most current values available. In addition, the toxicity values provided by HEAST are considered to be provisional, i.e., the value has had some form of agency review, but does not appear on IRIS. The HEAST values may or may not have been generated through the Agency Work Group process, but the values generally use all available information, use current methodology, and a consensus was reached by Agency scientists on the value. HEAST is, therefore, considered to be an unverified source of dose-response values and should be used only if no toxicity value is available on IRIS.

When a toxicity value is not available from IRIS or HEAST, the USEPA NCEA in Cincinnati may be consulted for provisional toxicity values. These toxicity values may or may not meet the HEAST criteria. The NCEA generally provides a toxicological summary for the value. The USEPA Region 3 Risk-Based Concentration (RBC) Table (USEPA, 2002b) and the USEPA Region 9 PRG Table (USEPA, 2000b) also use toxicity information from NCEA where available, and can serve as a source of these values. Therefore, the hierarchy of toxicity value sources correlates in general with the level of confidence in the values, with the values directly provided by NCEA having the lowest level of scientific review and approval and, thus, the least level of confidence.

4.2 Noncarcinogenic Toxicity Assessment

Constituents with known or potential noncarcinogenic effects are assumed to have a dose below which no adverse effect occurs or, conversely, above which an adverse effect may be seen. This dose is called the threshold dose. A conservative estimate of the true threshold dose is called a No Observed Adverse Effect Level (NOAEL). The lowest dose at which an adverse effect has been observed is called a Lowest Observed Adverse Effect Level (LOAEL). By applying uncertainty factors to the NOAEL or the LOAEL, Reference Doses (RfDs) for chronic exposure to chemicals with noncarcinogenic effects have been developed by USEPA (1997b, 2002a).

In regulatory toxicity assessment, USEPA assumes that humans are as sensitive, or more sensitive, to the toxic effects of a chemical as the most sensitive species use in the laboratory studies. Moreover, the RfD is developed based on the most sensitive or critical adverse health effect observed in the study population, with the assumption that if the most critical effect is prevented, then all other potential

toxic effects are prevented. Uncertainty factors are applied to the NOAEL (or LOAEL, when a NOAEL is unavailable) for this critical effect to account for uncertainties associated with the dose-response relationship. These include using an animal study to derive a human toxicity value, extrapolating from a LOAEL to a NOAEL, extrapolating from a subchronic (partial lifetime) to a chronic lifetime exposure, and evaluating sensitive subpopulations. Generally, a 10-fold factor is used to account for each of these uncertainties; thus, the total uncertainty factor can range from 10 to 10,000. In addition, an uncertainty factor or a modifying factor of up to 10 can be used to account for inadequacies in the database or other uncertainties. The resulting RfDs are very conservative, i.e., health protective, because of the use of the large uncertainty factors. For chemicals with noncarcinogenic effects, an RfD provides reasonable certainty that no noncarcinogenic health effects are expected to occur even if daily exposures were to occur at the RfD level for a lifetime. RfDs and exposure doses are expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day). The lower the RfD value, the lower is the assumed threshold for effects, and the greater the assumed toxicity.

Table 4-1 summarizes the toxicity information for COPCs with potential noncarcinogenic effects for the oral route of exposure. For each COPC, the chemical abstracts service number (CAS number), the dose-response value (RfD), and the reference for the toxicity value are presented. In addition, the USEPA confidence level in the value, the uncertainty factor, the modifying factor, the study animal, study method, target organ and critical effect upon which the toxicity value is based are also presented for each COPC, where available. The confidence level is provided for constituents published on IRIS, and is based on the confidence in the study and the extent of toxicity information available for that constituent.

No inhalation exposure scenarios are evaluated in this risk assessment. Therefore, inhalation toxicity information is not presented.

4.3 Carcinogenic Toxicity Assessment

In assessing the carcinogenic potential of a constituent, the Human Health Assessment Group of USEPA has classified constituents into one of the following groups (USEPA 1997b, 2002a), according to the weight of evidence from epidemiologic and animal studies:

- | | |
|---------|--|
| Group A | - Human Carcinogen (sufficient evidence of carcinogenicity in humans) |
| Group B | - Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans) |
| Group C | - Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data) |

- | | |
|---------|--|
| Group D | - Not Classifiable as to Human Carcinogenicity (inadequate or no evidence) |
| Group E | - Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in adequate studies) |

The underlying assumption of regulatory risk characterization for constituents with known or assumed potential carcinogenic effects is that no threshold dose exists. Thus, the characterization assumes that there is some finite level of risk associated with each non-zero dose. The USEPA has developed computerized models that extrapolate dose-response relations observed at the relatively high doses used in animal studies to the low dose levels encountered by humans in environmental situations. The mathematical models developed by USEPA assume no threshold, and use both animal and human data (where available) to develop a potency estimate for a given chemical. The potency estimate, called a cancer slope factor (CSF) is expressed in units of $(\text{mg}/\text{kg}\cdot\text{day})^{-1}$; the higher the CSF, the greater the carcinogenic potential.

Table 4-2 summarizes the toxicity information for COPCs classified by the USEPA as potential carcinogens for the oral route of exposure. For each constituent, the CAS number, USEPA carcinogenicity class, the oral cancer-slope factor and the reference are provided. In addition, the study animal and route of exposure upon which the CSF is based are presented.

No inhalation exposure scenarios are evaluated in this risk assessment. Therefore, inhalation toxicity information is not presented.

4.4 PCB Dose-Response

The biphenyl structure of PCBs consists of two aromatic 6-member rings connected by a single bond. There are five locations on each ring that can be chlorinated, and there are 209 individual PCB congeners, each identified by a unique congener number. Structurally, PCB congeners can be classified into groups based on the number of chlorines per molecule (e.g., monochloro-, dichloro-, trichloro-, up to decachloro-biphenyl). These groups are referred to as homologs.

Aroclor mixtures are the commercial mixtures of PCBs that were used in industry. The Aroclors are identified numerically (e.g., Aroclor 1260, Aroclor 1016). The higher the Aroclor number, the more enriched is the mixture in congeners containing higher numbers of chlorines. Each Aroclor mixture exhibits a characteristic, however overlapping, range of congeners, and Aroclors are identified and quantitated in samples by comparing the sample results to Aroclor standards. Total PCBs in a sample can be calculated by summing the Aroclor concentrations. Alternatively, PCBs can be quantitated by homolog and the homolog concentrations summed to give a total PCB concentration. This latter

method was used in the Sauget Area 1 risk assessment. Total PCB calculations following the steps outlined in Section 3.1.3 are presented in Attachment A.

Risks from potential exposures to PCBs have been calculated using the most current guidance available from USEPA. Currently, USEPA-approved guidance is provided in IRIS (USEPA, 2002a). Total PCB concentrations were calculated by summing the separate homolog concentrations. The total PCB concentrations were used to calculate the PCB exposure dose to be combined with the verified cancer slope factors listed in IRIS (USEPA, 2002a). Guidance provided in IRIS specifies three tiers of human slope factors for environmental PCBs: high risk and persistence, low risk and persistence, and lowest risk and persistence. The choice of slope factors for use depends on the medium of exposure and PCB chlorine content, as outlined in IRIS (USEPA, 2002a). These values are presented in Table 4-3. Based on a review of the media evaluated in the risk assessment and the CSF selection criteria, the CSF value of 2 (mg/kg-day)⁻¹ was used in the Sauget Area 1 risk assessment.

Non-cancer risks from potential exposures to PCBs were calculated using the most conservative RfD for a PCB mixture, the oral reference dose for Aroclor 1254 of 2E-05 mg/kg-day .

4.5 Dioxin Dose-Response

The potential carcinogenic effects associated with exposure to dioxin and furan congeners in environmental media were assessed in accordance with the approach developed by USEPA as follows. Risks were calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the toxic equivalency factors (TEFs) provided by World Health Organization (WHO) (Van den Berg et al., 1998). The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD. The TEFs are listed in Table 4-4. For each sample, the reported sample concentration (or half the detection limit, as appropriate, for non-detected congeners) for each dioxin and furan congener having a TEF listed by WHO was multiplied by its TEF, resulting in a TCDD toxic equivalence concentration (TCDD-TEQ). The TCDD-TEQ values for each of the congeners were then added together for each sample and treated as one sample concentration in the risk assessment. TCDD-TEQ calculations following the steps outlined above and in Section 3.1.3 are presented in Attachment A. The cancer slope factor for 2,3,7,8-TCDD was used to calculate potential carcinogenic risks resulting from potential exposure to 2,3,7,8-TCDD-TEQs.

4.6 Absorption Adjustment Factors

Differences exist in absorption between humans in an environmental situation and the animals generally used in the studies to develop the dose-response values. Absorption Adjustment Factors (AAFs) are used in a risk assessment to account for these differences. AAFs are discussed in greater detail in Section 5.5.2.

TABLE 4-1
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL NONCARCINOGENIC EFFECTS FROM CHRONIC EXPOSURE THROUGH THE ORAL ROUTE
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Constituent	CAS Number	Oral Dose-Response Value (mg/kg-day)	Reference (Last Verified) Type	EPA Confidence Level	Uncertainty Factor	Modifying Factor	Targent Organ/Critical Effect at LOAEL	Study Animal	Study Method	
1,4-Dichlorobenzene	106-46-7	3.00E-02	NCEA (b)	NA	NA	NA	NA	NA	NA	
4-Nitroaniline	100-01-6	NA	NA	NA	NA	NA	NA	NA	NA	
Arsenic	7440-38-2	3.00E-04	IRIS (5/2002)	MEDIUM	3	1	Hyperpigmentation and keratosis of the skin and poss. vascular complications	HUMAN	ORAL:DRINKING WATER	
Benzo(a)anthracene	56-55-3	NA	IRIS (5/2002)	NA	NA	NA	NA	NA	NA	
Benzo(a)pyrene	50-32-8	NA	IRIS (5/2002)	NA	NA	NA	NA	NA	NA	
Benzo(b)fluoranthene	205-99-2	NA	IRIS (5/2002)	NA	NA	NA	NA	NA	NA	
Bis(2-ethylhexyl)phthalate	117-81-7	2.00E-02	IRIS (5/2002)	MEDIUM	1000	1	Increased relative liver weight	GUINEA PIG	ORAL	
Copper	7440-50-8	3.70E-02	HEAST (1997)	NA	NA	NA	GI irritation	HUMAN	ORAL	
Dibenzo(a,h)anthracene	53-70-3	NA	IRIS (5/2002)	NA	NA	NA	NA	NA	NA	
Dieldrin	60-57-1	5.00E-05	IRIS (5/2002)	MEDIUM	100	1	Liver lesions	RAT	ORAL:DIET	
Heptachlor	76-44-8	5.00E-04	IRIS (5/2002)	LOW	300	1	Increased liver weight	RAT	ORAL:DIET	
Heptachlor epoxide	1024-57-3	1.30E-05	IRIS (5/2002)	LOW	1000	1	Increased liver to body-weight ratios	DOG	ORAL:DIET	
Pentachlorophenol	87-86-5	3.00E-02	IRIS (5/2002)	MEDIUM	100	1	Liver & kidney pathology	RAT	ORAL:DIET	
2,3,7,8-TCDD TEQ	1746-01-6	NA	HEAST (1997)	NA	NA	NA	NA	NA	NA	
Total PCBs	1336-36-3	2.00E-05	(a)	IRIS (5/2002)	MEDIUM	300	1	Ocular, meibomian gland, finger and toenail, and immune effects	MONKEY	ORAL:CAPSULE

Notes:

CAS - Chemical Abstracts Service.

LOAEL - Lowest Observed Adverse Effects Level.

NA - Not available.

RID - Reference Dose.

NCEA - National Center for Environmental Assessment.

IRIS - Integrated Risk Information System, an on-line computer database of toxicological information (USEPA, 2002a).

HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b).

(a) Value for Aroclor 1254 (IRIS).

(b) As reported in the USEPA Region 9 PRG Table (11/2000).

TABLE 4-2
DOSE-RESPONSE INFORMATION FOR COMPOUNDS WITH POTENTIAL CARCINOGENIC EFFECTS BY THE ORAL ROUTE OF EXPOSURE
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Constituent	CAS Number	EPA Carcinogen Class	Oral CSF (mg/kg-day) ⁻¹	Oral CSF Reference (Last Verified)	Oral CSF Study Animal	Oral CSF Study Method
1,4-Dichlorobenzene	106-46-7	C	2.40E-02	HEAST (1997)	MOUSE	ORAL:GAVAGE
4-Nitroaniline	100-01-6	NA	NA	NA	NA	NA
Arsenic	7440-38-2	A	1.50E+00	IRIS (5/2002)	HUMAN	ORAL:DRINKING WATER
Benzo(a)anthracene	56-55-3	B2	7.30E-01 (a)	IRIS (5/2002)	NA	NA
Benzo(a)pyrene	50-32-8	B2	7.30E+00	IRIS (5/2002)	MOUSE	ORAL:DIET
Benzo(b)fluoranthene	205-99-2	B2	7.30E-01 (a)	IRIS (5/2002)	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	B2	1.40E-02	IRIS (5/2002)	MOUSE	ORAL:DIET
Copper	7440-50-8	D	NA	IRIS (5/2002)	NA	NA
Dibenz(a,h)anthracene	53-70-3	B2	7.30E+00 (b)	IRIS (5/2002)	NA	NA
Dieldrin	60-57-1	B2	1.60E+01	IRIS (5/2002)	MOUSE	ORAL:DIET
Heptachlor	76-44-8	B2	4.50E+00	IRIS (5/2002)	MOUSE	ORAL:DIET
Heptachlor epoxide	1024-57-3	B2	9.10E+00	IRIS (5/2002)	MOUSE	ORAL:DIET
Pentachlorophenol	87-86-5	B2	1.20E-01	IRIS (5/2002)	MOUSE	ORAL:DIET
2,3,7,8-TCDD TEQ	1746-01-6	B2	1.50E+05	HEAST (1997)	RAT	ORAL:DIET
Total PCBs	1336-36-3	B2	2.00E+00 (c)	IRIS (5/2002)	RAT	ORAL:DIET

Notes:

CAS - Chemical Abstracts Service.
CSF - Cancer Slope Factor.
NA - Not available.
NCEA - National Center for Environmental Assessment
IRIS - Integrated Risk Information System, an online computer database of toxicological information (USEPA, 2002a).
HEAST - Health Effects Assessment Summary Tables, published annually by the USEPA (1997b).
(a) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 0.1 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d).
(b) CSF based on that for benzo(a)pyrene and applying a relative potency factor of 1.0 per USEPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (USEPA, 1993d).
(c) This is the upperbound CSF for high risk and persistence PCBs. USEPA provides a range of slope factors on IRIS; these will be discussed in the risk characterization.
(d) - Information for nickel, soluble salts on IRIS.

TABLE 4-3**TIERS OF CANCER SLOPE FACTORS FOR ENVIRONMENTAL PCBs (a)****SAUGET AREA 1 – CREEK BOTTOM SOILS****HUMAN HEALTH RISK ASSESSMENT****HIGH RISK AND PERSISTENCE**

Upper-bound slope factor: $2.0 \text{ (mg/kg-day)}^{-1}$
 Central-estimate slope factor: $1.0 \text{ (mg/kg-day)}^{-1}$

Criteria for use:

- Food chain exposure
- Sediment or soil ingestion
- Dust or aerosol inhalation
- Dermal exposure, if an absorption factor has been applied
- Presence of dioxin-like, tumor-promoting, or persistent congeners
- Early-life exposure (all pathways)

LOW RISK AND PERSISTENCE

Upper-bound slope factor: $0.4 \text{ (mg/kg-day)}^{-1}$
 Central-estimate slope factor: $0.3 \text{ (mg/kg-day)}^{-1}$

Criteria for use:

- Ingestion of water-soluble congeners
- Inhalation of evaporated congeners
- Dermal exposure if no absorption factor has been applied

LOWEST RISK AND PERSISTENCE

Upper-bound slope factor: $0.07 \text{ (mg/kg-day)}^{-1}$
 Central-estimate slope factor: $0.04 \text{ (mg/kg-day)}^{-1}$

Criteria for use:

Congener or isomer analyses verify that congeners with more than 4 chlorines comprise less than 0.5% of total PCBs.

(a) USEPA. 2002a. Integrated Risk Information System (IRIS).

TABLE 4-4
TEFs FOR DIOXIN AND FURAN CONGENERS
SAUGET AREA 1 CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSM

Constituent	CAS NO.	TEF (a)
Dioxins		
2,3,7,8-TetraCDD	1746-01-6	1
1,2,3,7,8-PentaCDD	40321-76-4	1
1,2,3,4,7,8-HexaCDD	39227-28-6	0.1
1,2,3,6,7,8-HexaCDD	57653-85-7	0.1
1,2,3,7,8,9-HexaCDD	19408-74-3	0.1
1,2,3,4,6,7,8-HeptaCDD	35822-39-4	0.01
OctaCDD	3268-87-9	0.0001
2,3,7,8-PentaCDDs	NA	NA
2,3,7,8-HexaCDDs	NA	NA
2,3,7,8-HeptaCDDs	NA	NA
Furans		
2,3,7,8-TetraCDF	51207-31-9	0.1
1,2,3,7,8-PentaCDF	57117-41-6	0.05
2,3,4,7,8-PentaCDF	57117-31-4	0.5
1,2,3,4,7,8-HexaCDF	70648-26-9	0.1
1,2,3,6,7,8-HexaCDF	57117-44-9	0.1
1,2,3,7,8,9-HexaCDF	72918-21-9	0.1
2,3,4,6,7,8-HexaCDF	60851-34-5	0.1
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	0.01
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	0.01
OctaCDF	39001-02-0	0.0001
2,3,7,8-HexaCDFs	NA	NA
2,3,7,8-HeptaCDFs	NA	NA
Notes:		
CAS - Chemical Abstracts Service.		
CDD- Chorodibenzodioxin		
CDF - Chlorodibenzofuran.		
TEF - Toxicity Equivalency Factor.		
(a) - "Toxic Equivalency Factors for PCBs, PCDDs, PCDFs for Humans and Wildlife."		
Van den Berg, et al. 1998.		

5.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios identifying appropriate environmental media and exposure pathways for current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPCs are identified and are judged to be complete are evaluated quantitatively in the risk assessment. This information is used to develop or update the CSM for the site.

To estimate the potential risk to human health that may be posed by the presence of COPCs in environmental media in the study area, it is first necessary to estimate the potential exposure dose of each COPC for each receptor. The exposure dose is estimated for each constituent via each exposure route/pathway by which the receptor is assumed to be exposed. Reasonable maximum exposure (RME) scenarios, and most likely exposure (MLE) scenarios based on appropriate USEPA guidance are both evaluated in the quantitative risk assessment. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day). The exposure doses are combined with the toxicity values to estimate potential risks and hazards for each receptor.

This section contains seven subsections. Section 5.1 presents the updated CSM for the site. Section 5.2 identifies the potential exposure scenarios and receptors. Section 5.3 presents the methods for quantifying potential exposures. Section 5.4 presents the receptor-specific exposure parameters, and Section 5.5 presents the constituent-specific exposure parameters. Section 5.6 discusses the risk calculations.

5.1 Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a CSM for human health was developed as part of the scoping activities in the HHRA Workplan (Solutia, 1999). The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors. The CSM is meant to be a "living" model that can be updated and modified as additional data become available.

The initial CSM for the site is presented in the HHRA Workplan (Figure 2-1, Solutia, 1999). Table 5-1 of the HHRA Workplan (Solutia, 1999) presented the matrix of receptors and pathways by area and medium that would be considered for evaluation in the risk assessment. The CSM and the receptor area matrix for creek bottom soil have been updated based on a review of the analytical results and the COPC selection process. The updated creek bottom soil CSM is presented in Figure 5-1. The updated creek bottom soil receptor/area matrix is presented in Table 5-1. Both are discussed below.

5.1.1 Dead Creek

Creek bottom soils in Site M, CS-B through CS-F were collected and analyzed after the UAO sediment removal action was complete. Sixteen COPCs were identified in creek bottom soil as shown in Table 3-1. Therefore, creek bottom soil is evaluated quantitatively in the HHRA as a potential exposure pathway (Figure 5-1).

The exposure scenarios (exposure pathways, exposure routes, and receptors) quantitatively evaluated in the risk assessment have been identified based on this current CSM. They are discussed in the next section.

5.2 Identification of Potential Exposure Scenarios and Receptors

Exposure scenarios are developed on the basis of the CSM for a site. A general identification of exposure pathways, exposure routes, and receptors is provided in the CSM (Figure 5-1) and Table 5-1, the receptor/area matrix. Table 5-1 was derived from the HHRA Workplan Table 5-1, based on the updated CSM presented above and results of the COPC identification process presented in Section 3.0.

Access to Dead Creek is generally uncontrolled except for CS-B, which is secured with a fence. COPCs were identified in creek bottom soil. Therefore, a recreational receptor (i.e., teenager) could be exposed to COPCs in creek bottom soil of Site M, CS-B through CS-F through wading or swimming. This scenario was evaluated in the HHRA.

Due to the presence of underground utility lines in several of the creek segments, it is possible that excavation work may occur in the future. Therefore, a construction worker receptor could be exposed to COPCs in creek bottom soil of Site M, and CS-B through CS-F during excavation. This scenario was evaluated in the HHRA.

5.3 Quantification of Potential Exposures

To estimate the potential risk to human health that may be posed by the presence of COPCs at the site, it is first necessary to estimate the potential exposure dose of each COPC. The exposure dose is

estimated for each constituent via each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day).

Exposure doses are defined differently for potential carcinogenic and noncarcinogenic effects. The Chronic Average Daily Dose (CADD) is used to estimate a receptor's potential intake from exposure to a COPC with noncarcinogenic effects. According to USEPA (1989a), the CADD should be calculated by averaging the dose over the period of time for which the receptor is assumed to be exposed. Therefore, the averaging period is the same as the exposure duration. For COPCs with potential carcinogenic effects, however, the Lifetime Average Daily Dose (LADD) is employed to estimate potential exposures. In accordance with USEPA (1989a) guidance, the LADD is calculated by averaging exposure over the receptor's assumed lifetime (70 years). Therefore, the averaging period is the same as the receptor's assumed lifetime. The standardized equations for estimating a receptor's average daily dose (both lifetime and chronic) are presented below, followed by descriptions of receptor-specific exposure parameters (Section 5.4) and constituent-specific parameters (Section 5.5).

Estimating Potential Exposure from Ingestion of and Dermal Contact with Creek Bottom Soil

Average Daily Dose (Lifetime and Chronic) Following Incidental Ingestion Creek Bottom Soil (mg/kg-day):

$$ADD = \frac{CS \times IR \times EF \times ED \times AAF_o \times CF}{BW \times AT}$$

where:

- | | | |
|------------------|---|--|
| ADD | = | Average Daily Dose (mg/kg-day) |
| CS | = | Soil concentration (mg/kg soil) |
| IR | = | Ingestion rate (mg soil/day) |
| EF | = | Exposure frequency (days) |
| ED | = | Exposure duration (year) |
| AAF _o | = | Oral-Soil Absorption Adjustment Factor (AAF) (unitless) |
| CF | = | Unit conversion factor (kg soil/10 ⁶ mg soil) |
| BW | = | Body weight (kg) |
| AT | = | Averaging time (days) |

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Creek Bottom Soil (mg/kg-day):

$$ADD = \frac{CS \times SA \times AF \times EF \times ED \times AAF_d \times CF}{BW \times AT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CS	=	Soil concentration (mg/kg soil)
SA	=	Exposed skin surface area (cm ² /day)
AF	=	Soil to skin adherence factor (mg soil/cm ²)
EF	=	Exposure frequency (days)
ED	=	Exposure duration (year)
AAF _d	=	Dermal-Soil AAF (unitless)
CF	=	Unit conversion factor (kg soil/10 ⁶ mg soil)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

5.3.1 Receptor-Specific Exposure Parameters

Exposure assumptions for the recreational teenager under the RME and MLE scenarios are shown in Table 5-2. Exposure assumptions for the construction worker under the RME and MLE scenarios are shown in Table 5-3. The soil ingestion rates used for the construction worker are described below.

Soil Ingestion Rate – Adult Construction Worker

Incidental soil ingestion occurs at all ages as a result of hand-to-mouth activities. Currently, there are little or no reliable quantitative data available for estimating adult soil ingestion rates. USEPA risk assessment guidance suggests a soil ingestion rate of 100 mg/day for adults in a residential scenario (USEPA, 1989a, 1991b), and a soil ingestion rate of 50 mg/day for adults in an industrial scenario (USEPA, 1991b).

USEPA presented an estimate of a soil ingestion rate for adults doing yard work of 480 mg/day in their supporting evidence for the commercial/industrial soil ingestion rate of 50 mg/day in the "Standard Default Exposure Factors" Directive (USEPA, 1991b); the 480 mg/day value was not presented in the table of default exposure factors. The Agency states: "For certain outdoor activities in the

commercial/industrial setting (e.g., construction or landscaping), a soil ingestion rate of 480 mg/day may be used; however, this type of work is usually short-term and is often dictated by the weather. Thus, exposure frequency would generally be less than one year and exposure duration would vary according to site-specific construction/maintenance plans." However, some regions and state agencies have stipulated the use of this value to evaluate a construction worker exposure scenario. The Hawley (1985) study, which is the basis for the soil ingestion rate of 480 mg/day, was recently reviewed by the USEPA (USEPA, 1997a), which stated that, "Given the lack of supporting measurements, these estimates must be considered conjectural."

In the Hawley (1985) study, the author assumed that soil adheres to the surface area of the hands at a loading of 3.5 mg/cm^2 . This value was based on a layer of soil on skin assumed to be 0.005 cm deep, a soil density of 1.5 g/cm^2 , and 50% void space. Using the author's derived soil-to-skin adherence loading of 3.5 mg/cm^2 and assuming that the amount of soil covering a fraction of the hands (approximately 70 cm^2) is ingested twice a day, Hawley calculated a soil ingestion rate of 480 mg/day.

Hawley's 1985 analysis was one of the first published health risk assessments and was performed before any of the quantitative fecal tracer soil ingestion studies for either children or adults were conducted (Calabrese et al., 1989; Davis et al., 1990; Clausing et al., 1987; Calabrese et al., 1990). Thus, the estimate of 480 mg/day predates all of our current knowledge about soil ingestion among both children and adults, as well as recent published data on soil-to-skin adherence rates.

In 1993, USEPA sponsored a workshop to evaluate soil-to-skin adherence data. As a result, a study to determine a more accurate characterization of soil-to-skin adherence was sponsored by the USEPA and conducted by John C. Kissel and associates at the University of Washington (Kissel et al., 1996; Holmes et al., 1998). The intent of this study was to resolve uncertainties and develop more accurate measures of soil-to-skin loading rates for individuals involved in various occupational and recreational activities. As reported in the Exposure Factors Handbook (EFH) (USEPA ,1997a), soil loading on skin surfaces as a result of various occupational and recreational activities was directly measured. This study indicates that soil loadings vary with the type of activity and the body parts contacted. As one would expect, adherence appears to be greatest during outdoor activities such as farming and gardening, and more soil/dust tends to adhere to the hands and knees than to other areas of the body.

Average hand soil loading factors are presented in the EFH (USEPA, 1997a) for the adult outdoor workers evaluated by Kissel and Holmes. In every case, soil adherence during occupational exposure was measured to be considerably lower than Hawley's estimate of 3.5 mg/cm^2 . The range of soil adherence loadings measured by Kissel and Holmes falls within the USEPA range of 0.2 to 1.0 mg/cm^2 (USEPA, 1992b).

For this evaluation, the construction worker receptor is assumed to be exposed to COPC in surface and subsurface soils during excavation activity. Based on this exposure scenario, the "farmer"

receptor provided in the EFH is considered to provide an upper-bound estimate of soil adherence. A soil ingestion rate can be calculated by substituting the soil adherence value for the receptor for the estimated value derived by Hawley (1985), as follows:

$$\frac{480 \text{ mg/day}}{3.5 \text{ mg/cm}^2} = \frac{\text{ingestion rate (mg / day)}}{\text{soil adherence (mg / cm}^2)}$$

The soil adherence value for the "farmer" is 0.47 mg/cm². The calculated soil ingestion value is 64 mg/day; therefore, a soil ingestion rate of 64 mg/day is used for the MLE construction worker receptor in this risk evaluation.

Additional support for this value comes from a paper by Kissel and coworkers (Kissel et al., 1998) that presents the results of a study of the transfer of soil from hand to mouth by intentional licking. Soil was loaded onto the skin by pressing the hand onto soil, and the amount transferred to the mouth was measured. The thumb sucking, finger mouthing, and palm licking activities resulted in geometric mean soil mass transfers of 7.4 to 16 mg per event. The author concludes that "transfer of 10 mg or more of soil from a hand to the oral cavity in one event is possible, but requires moderate soil loading and more than incidental hand-to-mouth contact." However, "the fraction of soil transferred from hand to mouth that is subsequently swallowed is unknown but may be less than 100 percent." In addition, "the adult volunteers in this study reported that the presence of roughly 10 mg of soil in the mouth is readily detected (and unpleasant). Repeated unintentional ingestion of that mass of soil by adults therefore seems unlikely. In light of this observation, the 480 mg per day estimate [of Hawley, 1985] would require hundreds or perhaps thousands of hand-to-mouth contacts that resulted in soil transfer per day."

For the RME scenario, a soil ingestion rate of 100 mg/day is assumed for the construction worker. This is the adult soil ingestion rate provided by USEPA (1991b). For the MLE scenario, the soil ingestion rate of 64 mg/kg derived above was used.

5.4 Constituent-Specific Parameters

There are several constituent-specific parameters used in the exposure equations above. These parameters are discussed below.

5.4.1 Exposure Point Concentrations

Exposure points are located where potential receptors may contact COPCs at or from the site. The concentration of COPCs in the environmental medium that receptors may contact must be estimated in

order to determine the magnitude of potential exposure. The estimation of exposure point concentrations (EPCs) in media evaluated for the HHRA is discussed below.

The EPC for a human health risk assessment is defined as the 95% upper confidence limit (95% UCL) on the arithmetic mean concentration, or the maximum concentration, whichever is lower (USEPA, 1992a), for the RME scenario and the arithmetic mean concentration for the MLE scenario.

Summary statistics have been calculated for each COPC in creek bottom soil, as presented in Attachment A. As discussed in Section 3.0, before summary statistics were calculated, the following steps were taken for each COPC. If a constituent was detected at least once in an area, one-half the constituent's quantitation limit was used as a proxy concentration in the estimation of exposure point concentrations for those instances in which the constituent was reported as not detected. However, if the proxy concentration is greater than any detected value in that area/medium, the proxy concentration was removed from the calculation. This is consistent with USEPA guidance (USEPA, 1989a) which recognizes that high sample quantitation limits can lead to unrealistic concentration estimates. Duplicate sample analytical results were averaged, and the average used as the sample point concentration (USEPA, 1989b).

The equation used to calculate the 95% UCL is dependent upon the distribution of the data set. If data are normally distributed, the following equation is used (USEPA, 1992a):

$$95\% \text{ UCL} = \bar{x} + t(s / \sqrt{n})$$

where:

- \bar{x} = mean of data
- s = standard deviation of the data
- t = student t-statistic
- n = number of samples

If the data are lognormally distributed, the 95% UCL is calculated using the transformed data set and the H-statistic (USEPA, 1992a). The data are "transformed" by using the natural logarithmic function, i.e., by calculating $\ln(x)$ for each x value in the data set.

$$95\% \text{ UCL} = e^{(\bar{x} + 0.5s^2 + sH / \sqrt{n-1})}$$

Where:

- e = base of the natural log, equal to 2.718
- \bar{x} = mean of the transformed data
- s = standard deviation of the transformed data
- H = H-statistic
- n = the number of samples in the population

Student's t-statistic values were obtained from Gilbert (1987). H-statistic values were obtained from Land (1975). Land presents H-statistic values for up to 1000 degrees of freedom (n-1) in matrix tables based on confidence level and standard deviation. H-statistic values were selected using the 0.95 confidence column and the standard deviation of the transformed data rounded to the nearest tenth. The matrix table most closely matching the number of degrees of freedom for the data was selected. For instance, for a sample dataset containing 50 samples, and therefore 49 degrees of freedom, the matrix table for 50 degrees of freedom is selected because a table for 49 degrees of freedom is not provided.

The Shapiro-Wilk Test for Normality (W-test) is used to determine which 95% UCL value is appropriate for use as an EPC for each COPC. The results of the W-test indicate whether the data set is more likely to be normally or lognormally distributed. The UCL based on the student t-statistic is selected where the data set is more likely to be normally distributed, while the UCL based on the H-statistic is selected where the data set is more likely to be lognormally distributed. The W-test values were calculated and compared for the log-transformed and untransformed data sets. If the log-transformed data have the higher W-test value, the data are assumed to be more lognormally distributed, and the H-statistic 95% UCL value is the appropriate UCL. Similarly, if the untransformed data have the higher W-test value, the data are assumed to be more normally distributed, and the t-statistic 95% UCL is the appropriate UCL.

EPCs for each of the COPC identified in Section 3.0 have been selected using the above described procedure. The tables in Attachment A (Summary Statistics) present for each constituent detected the W-test results, the log-transformed and untransformed 95% UCLs, the selected 95% UCL, and the selected EPC. The EPCs for creek bottom soil are presented in Table 5-4 for the RME scenario. The EPCs for creek bottom soil are presented in Table 5-5 for the MLE scenario.

5.4.2 Absorption Adjustment Factors

Bioavailability is the measure of the degree to which a chemical may be systemically absorbed following exposure. In accordance with USEPA guidance (USEPA, 1989a, 1992c), absorption adjustment factors (AAFs) for bioavailability will be used in conducting this risk evaluation. To estimate the potential risk to human health that may be posed by the presence of COPCs in various environmental media (such as soil, creek bottom soil, water or air), it is first necessary to estimate the

human exposure dose of each chemical. The exposure dose is then combined with an estimate of the toxicity of the chemical to produce an estimate of risk posed to human health.

The estimate of toxicity of a chemical, termed the toxicity value, can be derived from human epidemiological data, but it is most often derived from experiments with laboratory animals. The toxicity value can be calculated based on the administered dose of the chemical (similar to the human exposure dose) or, when data are available, based on the absorbed dose, or internal dose, of the chemical.

In animals, as in humans, the administered dose of a chemical is not necessarily completely absorbed. Moreover, differences in absorption exist between laboratory animals and humans, as well as between different media and routes of exposure. Therefore, it is not always appropriate to directly apply a toxicity value to the human exposure dose. In many cases, a correction factor in the calculation of risk is needed to account for differences between absorption in the toxicity study and absorption likely to occur upon human exposure to a chemical. Without such a correction, the estimate of human health risk could be over- or under-estimated.

This correction factor is termed the absorption adjustment factor, or AAF. The AAF is used to adjust the human exposure dose so that it is expressed in the same terms as the doses used to generate the dose-response curve in the dose-response study. The AAF is the ratio between the estimated human absorption for the specific medium and route of exposure, and the known or estimated absorption for the laboratory study from which the dose-response value was derived.

$$AAFs = \frac{\text{fraction absorbed in humans for the environmental exposure}}{\text{fraction absorbed in the dose - response study}}$$

The use of an AAF allows appropriate adjustments to be made to the administered dose of a chemical when the efficiency of absorption between environmental exposure and experimental exposure is known or expected to differ because of physiological effects and/or matrix or vehicle effects.

AAFs can have numerical values less than one or greater than one. When the toxicity curve is based on administered dose data, and if it is estimated that the fraction absorbed from the site-specific exposure or medium is the same as the fraction absorbed in the laboratory study, then the AAF is 1.0. This does not mean that there is 100% absorption, only that the magnitude of absorption is the same in both cases. There are situations in which it is expected that the fraction absorbed from a site-related exposure would be higher than that in the laboratory study. There are also situations where the reverse could occur. Thus, use of AAFs provides more accurate and more realistic estimates of potential human health risk. In the absence of detailed toxicological information on a COPC, the following default AAF values are generally employed. A default AAF value of 0.01 is used for dermal

exposure to organics, a value of 0.001 is used for dermal exposure to inorganics (USEPA, 2000a), and a value of 1.0 is employed for all other routes of exposure.

Support for the Use of AAFs in Agency Guidance

The use of absorption factors is recommended by USEPA for use in risk assessment when the "medium of exposure in the site exposure assessment differs from the medium of exposure assumed by the toxicity value" (USEPA, 1989a). In more recent guidance (USEPA, 1992c), USEPA states:

The applied dose, or the amount that reaches exchange boundaries of the skin, lung or gastrointestinal tract, may often be less than the potential dose if the material is only partly bioavailable. Where data on bioavailability are known, adjustments to the potential dose to convert it to applied dose and internal dose may be made.

This may be done by adding a bioavailability factor (range: 0 to 1) to the dose equation. The bioavailability factor would then take into account the ability of the chemical to be extracted from the matrix, absorption through the exchange boundary, and any other losses between ingestion and contact with lung or gastrointestinal tract.

AAFs used in this risk assessment are presented in Table 5-6. All COPCs with the exception of bis(2-ethylhexyl)phthalate were also COPCs in the USEPA-approved HHRA for Sauget Area 1 (Solutia, 2001). Appendix O of Solutia, 2001 presents the derivations of these AAFs. The derivation of the AAFs for bis(2-ethylhexyl)phthalate is presented in Attachment E to this document.

5.5 Exposure Dose Calculations

Attachment F presents the exposure dose and risk calculation spreadsheets. The risk results are discussed in Section 6.0.

TABLE 5-1
 RECEPTOR-AREA MATRIX
 SAUGET AREA 1 CREEK BOTTOM SOILS
 SAUGET AND CAHOKIA, ILLINOIS
 SOUTIA, INC.

<i>Receptor</i>	Medium Secondary Medium (Pathways)	Exposure Areas						Total Receptors
		Fill Area/Sites	CS-B	CS-C	CS-D	CS-E	CS-F	
<i>Recreational Teen (RT)</i>	M (lagoon)							
Creek Bottom Soils (ing/derm)	RT-RME-M RT-MLE-M	RT-RME-CS-B RT-MLE-CS-B	NA NA		RT-RME-CS-D RT-MLE-CS-D	RT-RME-CS-E RT-MLE-CS-E	RT-RME-CS-F RT-MLE-CS-F	5 5
<i>Construction Worker (CW)</i>								
Creek Bottom Soils (ing/derm)	CW-RME-M CW-MLE-M	CW-RME-CS-B CW-MLE-CS-B	NA NA		CW-RME-CS-D CW-MLE-CS-D	CW-RME-CS-E CW-MLE-CS-E	CW-RME-CS-F CW-MLE-CS-F	5 5
Total Receptors	4	4	NA	4	4	4	4	20
Notes:								
RME - Reasonable Maximum Exposure.								
MLE - Most Likely Exposure.								
NA - Not applicable; no constituents of potential concern (COPC) identified in this creek segment.								
ing - ingestion.								
derm - dermal contact.								
inh - inhalation.								

TABLE 5-2

SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL TEENAGER
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Parameter	RME Recreational Teenager (7 to 18 yrs)	MLE Recreational Teenager (7 to 18 yrs)
Parameters Used in the Dead Creek and Site M Creek Bottom Soils Pathway - Wading		
Exposure Frequency (days/year)	26	(a)
Exposure Duration (yr)	11	(c)
Soil Ingestion Rate (mg/day)	100	(d)
Skin Contacting Medium (cm ²)	2029	(f)
Soil on Skin (mg/cm ²)	1	(g)
Body Weight (kg)	47	(h)

Notes:

MLE - Most Likely Exposure.
 RME - Reasonable Maximum Exposure.

(a) - 1 day per week for 26 weeks (6 months) of the year.
 (b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
 (c) - Recreational teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
 (d) - USEPA, 1991b. Standard Default Exposure Factors.
 (e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
 (f) - USEPA, 1997a. Exposure Factors Handbook. Average surface area of feet and 1/4 the legs of males and females aged 7-18.
 (g) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
 (h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7-18.

6/17/2002

TABLE 5-3

SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - CONSTRUCTION WORKER
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Parameter	RME Future Construction/Utility Worker	MLE Future Construction/Utility Worker
Parameters Used in the Dead Creek and Site M Creek Bottom Soils Pathway		
Exposure Frequency (days/year)	40	(a)
Exposure Duration (yr)	1	(c)
Soil Ingestion Rate (mg/day)	100	(d)
Skin Contacting Medium (cm ²)	3339	(f)
Soil on Skin (mg/cm ²)	1.00	(g)
Body Weight (kg)	70	(d)
Notes:		
MLE - Most Likely Exposure.		
RME - Reasonable Maximum Exposure.		
(a) - Exposure frequency is equivalent to 5 days per week for 2 months.		
(b) - Exposure frequency is equivalent to five days per week for one month.		
(c) - Construction activities are assumed to occur over a 1 year period.		
(d) - USEPA, 1991b. Standard Default Exposure Factors.		
(e) - ENSR-derived value; described briefly in the text.		
(f) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.		
(g) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.		

6/13/2002

TABLE 5-4
 EXPOSURE POINT CONCENTRATIONS (RME) - CREEK BOTTOM SOILS
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	CAS	Creek Segment B (mg/kg)	Creek Segment D (mg/kg)	Creek Segment E (mg/kg)	Creek Segment F (mg/kg)	Site M (mg/kg)
1,4-Dichlorobenzene	106-46-7	0.27	--	--	--	4.10
4-Nitroaniline	100-01-6	0.74	--	--	--	--
Arsenic	7440-38-2	11.40	18.00	11.00	11.37	11.47
Benzo(a)anthracene	56-55-3	0.17	--	--	--	--
Benzo(a)pyrene	50-32-8	0.11	0.14	0.11	0.08	0.48
Benzo(b)fluoranthene	205-99-2	0.16	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	0.35	--	--	--	--
Copper	7440-50-8	1114.53	--	1088.14	--	4900.00
Dibenzo(a,h)anthracene	53-70-3	0.08	--	0.08	--	0.15
Dieldrin	60-57-1	0.009	0.69	--	--	--
Heptachlor	76-44-8	--	--	--	--	0.10
Heptachlor epoxide	1024-57-3	0.01	--	--	--	0.86
Lead	7439-92-1	122.58	--	--	85.10	--
Pentachlorophenol	87-86-5	0.26	--	--	--	--
2,3,7,8-TCDD TEQ	1746-01-6	0.0003	--	--	--	0.0051
Total PCBs	1336-36-3	1.74	2.44	0.27	--	24.76

Notes:
 -- Not a COPC in this area/medium.
 CAS - Chemical Abstracts Service.
 COPC - Constituent of Potential Concern.
 EPC - Exposure Point Concentration.
 RME - Reasonable Maximum Exposure.

TABLE 5-5
 EXPOSURE POINT CONCENTRATIONS (MLE) - CREEK BOTTOM SOILS
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	CAS	Creek Segment B (mg/kg)	Creek Segment D (mg/kg)	Creek Segment E (mg/kg)	Creek Segment F (mg/kg)	Site M (mg/kg)
1,4-Dichlorobenzene	106-46-7	0.29	--	--	--	0.98
4-Nitroaniline	100-01-6	0.76	--	--	--	--
Arsenic	7440-38-2	9.72	11.40	8.08	9.71	7.28
Benzo(a)anthracene	56-55-3	0.17	--	--	--	--
Benzo(a)pyrene	50-32-8	0.11	0.08	0.09	0.07	0.21
Benzo(b)fluoranthene	205-99-2	0.16	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	1.77	--	--	--	--
Copper	7440-50-8	484.20	--	425.21	--	1437.78
Dibenzo(a,h)anthracene	53-70-3	0.07	--	0.07	--	0.08
Dieldrin	60-57-1	0.008	0.13	--	--	--
Heptachlor	76-44-8	--	--	--	--	0.03
Heptachlor epoxide	1024-57-3	0.01	--	--	--	0.11
Lead	7439-92-1	74.61	--	--	58.13	--
Pentachlorophenol	87-86-5	0.99	--	--	--	--
2,3,7,8-TCDD TEQ	1746-01-6	0.0002	--	--	--	0.0010
Total PCBs	1336-36-3	2.78	0.49	0.19	--	5.40

Notes:

-- Not a COPC in this area/medium.

CAS - Chemical Abstracts Service.

COPC - Constituent of Potential Concern.

EPC - Exposure Point Concentration.

MLE - Most Likely Exposure.

TABLE 5-6
ABSORPTION ADJUSTMENT FACTORS (AAFs) FOR CHRONIC EXPOSURE
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Constituent	Exposure Route (Medium)			
	Oral Carc.	(Soil) Noncarc.	Dermal Carc.	(Soil) Noncarc.
1,4-Dichlorobenzene	1	1	0.01	0.01
4-Nitroaniline	NA	NA	NA	NA
Arsenic	0.3	0.3	0.001	0.001
Benzo(a)anthracene	0.29	NA	0.02	NA
Benzo(a)pyrene	0.29	NA	0.02	NA
Benzo(b)fluoranthene	0.29	NA	0.02	NA
Bis(2-ethylhexyl)phthalate	1	1	0.004	0.004
Copper	NA	1	NA	0.002
Dibenzo(a,h)anthracene	0.29	NA	0.02	NA
Dieldrin	1	1	0.01	0.01
Heptachlor	1	1	0.01	0.01
Heptachlor epoxide	1	1	0.01	0.01
Pentachlorophenol	1	1	0.01	0.01
2,3,7,8-TCDD TEQ	0.5	NA	0.05	NA
Total PCBs	0.83	0.83	0.04	0.04
Notes:				
All Absorption Adjustment Factors were derived by ENSR.				
Carc. - The value derived is for assessing the compound's carcinogenic potential.				
Noncarc. - The value derived is for assessing the compound's noncarcinogenic potential.				

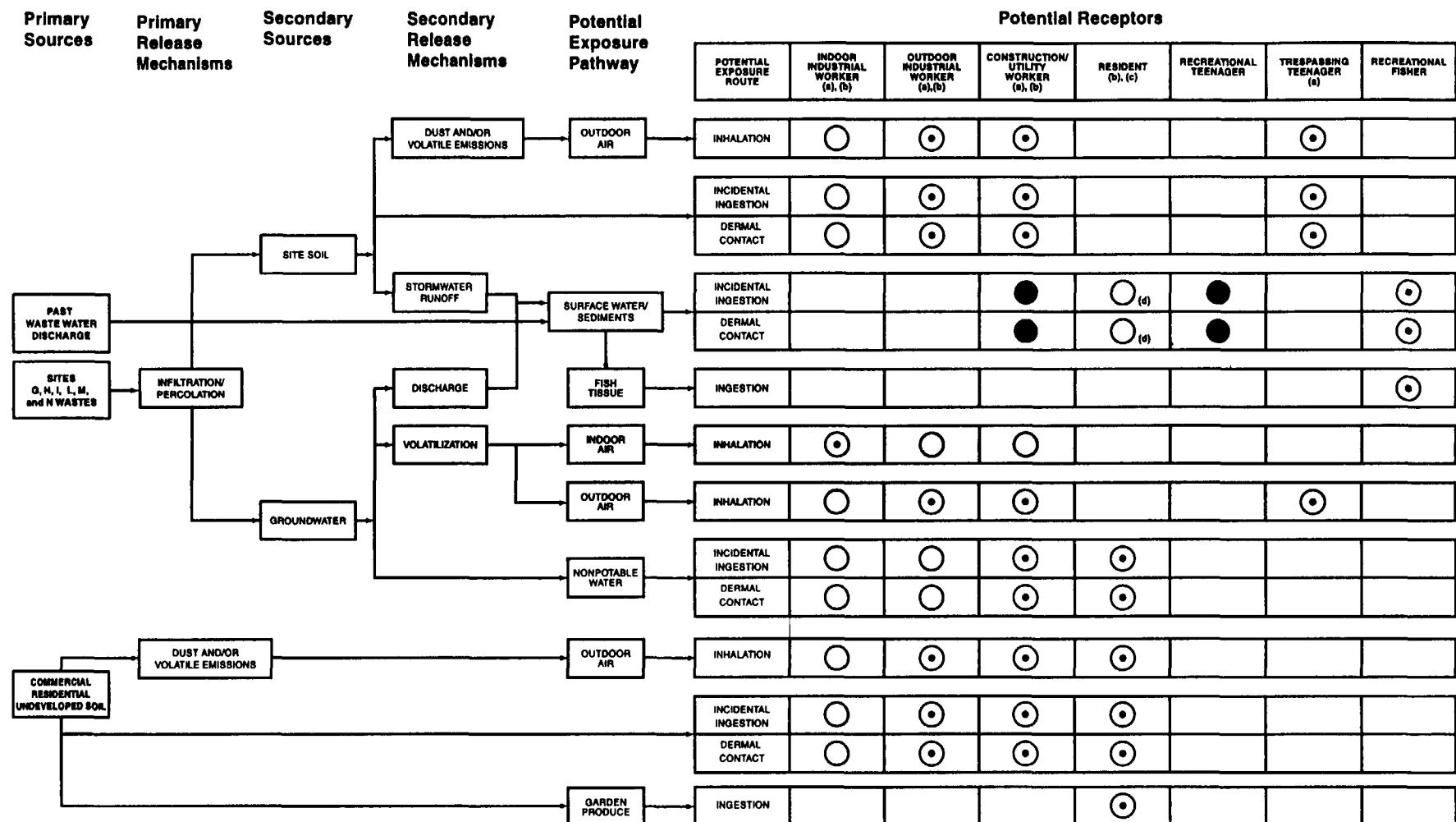

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FIGURE 5-1
Conceptual Site Model for Human Health Risk Assessment
Sauget Area 1 Creek Bottom Soils, Sauget and Cahokia, Illinois Solutia, Inc.

Boxes without circles indicate that pathway is not applicable to that receptor

6.0 RISK CHARACTERIZATION

The potential risk to human health associated with potential exposure to COPC in creek bottom soil at the site is evaluated in this step of the risk assessment process. Risk characterization is the process in which the dose-response information (Section 4.0) is integrated with quantitative estimates of human exposure derived in the Exposure Assessment (Section 5.0). The result is a quantitative estimate of the likelihood that humans will experience any adverse health effects given the exposure assumptions made. Two general types of health risk are characterized for each potential exposure pathway considered: potential carcinogenic risk and potential noncarcinogenic risk. Carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (1989a), is assumed to be 70 years. Noncarcinogenic risk is evaluated by averaging exposure over the total exposure period.

Characterization of the potential impact of potential carcinogenic and noncarcinogenic constituents is approached in very different ways. The difference in approaches arises from the conservative assumption that substances with possible carcinogenic action proceed by a no-threshold mechanism, whereas other toxic actions may have a threshold, a dose below which few individuals would be expected to respond. Thus, under the no-threshold assumption, it is necessary to calculate a risk, but for constituents with a threshold, it is possible to simply characterize an exposure as above or below the threshold. In risk assessment, that threshold is termed a reference dose (RfD). Reference doses as well as cancer slope factors were discussed in Section 4.0. The approach to carcinogenic risk characterization is presented in Section 6.1, and the approach to noncarcinogenic risk characterization is presented in Section 6.2. The risk characterization results for the recreational teenager are presented in Section 6.3. Uncertainties associated with the risk characterization are presented in Section 6.4. The risk calculation spreadsheets are presented in Attachment F.

6.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a constituent in environmental media at the site. This likelihood is a function of the dose of a constituent (described in the Exposure Assessment, Section 5.0) and the Cancer Slope Factor (CSF) (described in the Toxicity Assessment, Section 4.0) for that constituent. The Excess Lifetime Cancer Risk (ELCR) is the likelihood over and above the background cancer rate, which currently in the US is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., 10^{-6} , or one in one million). The relationship between the ELCR and the estimated Lifetime Average Daily Dose (LADD) of a constituent may be expressed as:

$$ELCR = 1 - e^{-(CSF \times LADD)}$$

When the product of the CSF and the LADD is much greater than 1, the ELCR approaches 1 (i.e., 100 percent probability). When the product is less than 0.01 (one chance in 100), the equation can be closely approximated by:

$$ELCR = LADD \text{ (mg/kg-day)} \times CSF \text{ (mg/kg-day)}^{-1}$$

The product of the CSF and the LADD is unitless, and provides an upper-bound estimate of the potential carcinogenic risk associated with a receptor's exposure to that constituent via that pathway.

The potential carcinogenic risk for each exposure pathway is calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks are summed to estimate the total site potential cancer risk for each receptor. A summary of the total site cancer risks for each receptor group is presented in this section and compared to the USEPA's target risk range of 10^{-4} to 10^{-6} . Any COPC that causes an exceedence of 10^{-4} risk level for a particular receptor is designated a COC. The target risk levels used for the identification of COCs are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

"Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} , and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,

"The upper boundary of the risk range is not a discrete line at 1×10^{-4} , although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions."

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

"The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [10^{-4}]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level."

Both RME and MLE results are considered in the identification of COCs.

6.2 Noncarcinogenic Risk Characterization

The potential for exposure to a constituent to result in adverse noncarcinogenic health effects is estimated for each receptor by comparing the Chronic Average Daily Dose (CADD) for each COPC with the RfD for that COPC. The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that constituent. The HQ is calculated using the following equation:

$$HQ = \frac{CADD\ (mg/kg\text{-day})}{RfD\ (mg/kg\text{-day})}$$

The target HQ is defined as a HQ of less than or equal to one (USEPA, 1989a). When the HQ is less than or equal to 1, the RfD has not been exceeded, and no adverse noncarcinogenic effects are expected. If the HQ is greater than 1, there may be a potential for adverse noncarcinogenic health effects to occur; however, the magnitude of the HQ cannot be directly equated to a probability or effect level.

The total Hazard Index (HI) is calculated for each exposure pathway by summing the HQs for each individual constituent. The total site HI is calculated for each potential receptor by summing the HIs for each pathway associated with the receptor. Where the total site HI is greater than 1 for any receptor, a more detailed evaluation of potential noncarcinogenic effects based on specific health or target endpoints (e.g., liver effects, neurotoxicity) is performed (USEPA, 1989a; IEPA, 1998). The target HI is 1 on a per target endpoint basis. Each COPC that causes an exceedance of the HI of 1 for a particular receptor and for a particular target endpoint is designated a COC. Both RME and MLE results are considered in the identification of COCs.

6.3 Risk Characterization Results

Risk characterization results for the recreational teen are presented in Section 6.3.1, and for the construction worker in Section 6.3.2.

6.3.1 Recreational Teen

Potential carcinogenic risks for the RME and MLE scenarios are presented in Table 6-1, and the potential HIs for the RME and MLE scenarios are presented in Table 6-2. The recreational teen is assumed to be exposed to COPCs in creek bottom soil (wading and swimming) in Dead Creek Segments B,D, E, F and Site M via incidental ingestion and dermal contact.; no COPCs were identified in creek segment C.

As indicated in Table 6-1, the potential risk for the recreational teen (RME) for each of the creek segments is within the USEPA risk range of 10^{-4} to 10^{-6} . Table 6-1 indicates that the potential risks for the MLE scenario for each of the creek segments are also within the USEPA risk range of 10^{-4} to 10^{-6} .

Table 6-2 indicates that the potential HI for the recreational teen (RME) for each of the creek segments is below the target HI of 1. The table also indicates that the potential HI for the recreational teen (MLE) for each of the creek segments is below the target HI of 1.

6.3.2 Construction Worker

Potential carcinogenic risks for the RME and MLE scenarios are presented in Table 6-3, and the potential HIs for the RME and MLE scenarios are presented in Table 6-4. The construction worker is assumed to be exposed to COPCs in creek bottom soil during excavation in Dead Creek Segments B,, D, E, F and Site M via incidental ingestion and dermal contact; no COPCs were identified in creek segment C.

As indicated in Table 6-3, the potential risk for the construction worker (RME) for each of the creek segments is within the USEPA risk range of 10^{-4} to 10^{-6} . Table 6-3 indicates that the potential risks for the MLE scenario for each of the creek segments are also within the USEPA risk range of 10^{-4} to 10^{-6} .

Table 6-4 indicates that the potential HI for the construction worker (RME) for each of the creek segments is below the target HI of 1. The table also indicates that the potential HI for the construction worker (MLE) for each of the creek segments is below the target HI of 1.

6.4 Uncertainty Analysis

Within any of the four steps of the human health risk assessment process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk assessment process. Regulatory risk assessment methodology requires that conservative assumptions be made throughout the risk assessment to ensure that public health is protected. Therefore, when all of the assumptions are combined, it is much more likely that risks are overestimated rather than underestimated.

The assumptions that introduce the greatest amount of uncertainty in this risk assessment are discussed in this section. They are discussed in qualitative terms, because for most of the assumptions there is not enough information to assign a numerical value to the uncertainty that can be factored into the calculation of risk.

6.4.1 Selection of Constituents of Potential Concern

In the Hazard Identification step, information on constituents detected at the site is combined with criteria quantifying their potential toxicity to obtain a subset of constituents for quantitative evaluation in the risk assessment, the COPCs. The goal is to include in the quantitative portion of the risk assessment those constituents that are the most toxic, prevalent, environmentally-persistent, and mobile. The selection of the COPCs forms the basis of the quantitative risk assessment.

Generally in the site characterization phase of the site assessment, knowledge of past and current land use is used to determine which analytical parameters are analyzed and what analytical methods are employed for the detection of constituents in the relevant environmental media at the site. However, for Sauget Area 1, the knowledge of past and current industrial practices was not used to limit the analyte list. Instead, the majority of environmental samples were analyzed for a full suite of constituents including VOCs, SVOCs, metals, cyanide, PCBs, pesticides, herbicides and dioxins, as detailed in Section 3.1.2.

In the Hazard Identification process, it is assumed that only those constituents detected are actually present at the site. However, it is possible that constituents not on the analyte list may be present at the site. Should this be the case, site risks may be underestimated depending on the nature of the constituents not included in the sample analyses. However, the full suite of USEPA analyte lists were used and are as inclusive as possible of constituents used in industry that are of potential public health concern. Therefore, it is unlikely that constituents not included on the analyte list would be present at the site at concentrations that would pose a risk to public health.

A subset of constituents detected at a site is generally selected for quantitative analysis for several reasons. Some constituents detected at a site may be naturally occurring and not related to site use. Other constituents may be present at concentrations that can be assumed with reasonable assurance not to pose a risk to human health. A review of the results of risk assessments demonstrate that in most cases risks are attributable only to one or a few constituents, and that many of the constituents quantitatively evaluated do not contribute significantly to total risk estimates (USEPA, 1993a). The screening process is conducted to identify the COPCs that may contribute the greatest to potential risk. The screening process used here is conservative. Although the excluded constituents may pose a finite level of risk, that risk would contribute negligibly to the total site risk. Therefore, not evaluating the excluded constituents will not measurably affect the numerical estimates of hazard or risk, and thus not affect remedial decision-making at the site.

In comparison with the list of constituents analyzed in each environmental sample (approximately 180 analytes), relatively few constituents were detected in Dead Creek segments and Site M, and of these, relatively few COPCs (a total of sixteen) were identified for quantitative evaluation in the risk assessment for creek bottom soil. The COPCs identified are listed in 3-1.

6.4.2 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects a constituent may potentially cause and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response). Risk assessment methodologies typically divide potential health effects of concern into two general categories: effects with a threshold (noncarcinogenic) and effects assumed to be without a threshold (potentially carcinogenic). Toxicity assessments for both of these types of effects share many of the same sources of uncertainty. To compensate for these uncertainties, USEPA has developed the RfDs and CSF that are biased to overestimate rather than under-estimate human health risks. Several of the more important sources of uncertainty and the resulting biases are discussed below.

6.4.2.1 Animal-to-Human Extrapolation in Noncarcinogenic Dose-Response Evaluation

For many constituents, animal studies provide the only reliable information on which to base an estimate of adverse human health effects. Extrapolation from animals to humans introduces a great deal of uncertainty into the risk characterization. In most instances, it is not known how differently a human may react to the constituent compared to the animal species used to test the constituent. If a constituent's fate and the mechanisms by which it causes adverse effects are known in both animals and humans, uncertainty is reduced. When the fate and mechanism for the constituent are unknown, uncertainty increases.

The procedures used to extrapolate from animals to humans involve conservative assumptions and incorporate uncertainty factors such that overestimation of effects in humans is more likely than underestimation. When data are available from several species, the lowest dose that elicits effects in the most sensitive species is used for the calculation of the RfD. To this dose are applied uncertainty factors, generally of 1 to 10 each, to account for intraspecies variability, interspecies variability, study duration, and/or extrapolation of a low effect level to a no effect level. Thus, most reference doses used in risk assessment are 100- to 10,000-fold lower than the lowest effect level found in laboratory animals.

Nevertheless, because the fate of a constituent can differ in animals and humans, it is possible that animal experiments will not reveal an adverse effect that would manifest itself in humans. This can result in an underestimation of the effects in humans. The opposite may also be true: effects observed in animals may not be observed in humans, resulting in an overestimation of potential adverse human health effects.

6.4.2.2 Evaluation of Carcinogenic Dose-Response

Significant uncertainties exist in estimating dose-response relationships for potential carcinogens. These are due to experimental and epidemiologic variability, as well as uncertainty in extrapolating both from animals to humans and from high to low doses. Three major issues affect the validity of toxicity assessments used to estimate potential excess lifetime cancer risks: (1) the selection of a study (i.e., data set, animal species, matrix the constituent is administered in) upon which to base the calculations, (2) the conversion of the animal dose used to an equivalent human dose, and (3) the mathematical model used to extrapolate from experimental observations at high doses to the very low doses potentially encountered at the site.

Study Selection

Study selection involves the identification of a data set (experimental species and specific study) that provides sufficient, well-documented dose-response information to enable the derivation of a valid CSF. Human data (e.g., from epidemiological studies) are preferable to animal data, although adequate human data sets are relatively uncommon. Therefore, it is often necessary to seek dose-response information from a laboratory species, ideally one that biologically resembles humans (e.g., with respect to metabolism, physiology, and pharmacokinetics), and where the route of administration is similar to the expected mode of human exposure (e.g., inhalation and ingestion). When multiple valid studies are available, the USEPA generally bases CSFs on the one study and site that show the most significant increase in tumor incidence with increasing dose. In some cases this selection is done in spite of significant decreases with increasing dose of tumor incidence in other organs and total tumor incidence. Consequently, the current study selection criteria are likely to lead to overestimation of potential cancer risks in humans.

Interspecies Dose Conversion

The USEPA derivation of human equivalent doses by conversion of doses administered to experimental animals requires the assumption that humans and animals are equally sensitive to the toxic effects of a substance, if the same dose per unit body surface area is absorbed by each species. Although such an assumption may hold for direct-acting genotoxins, it is not necessarily applicable to many indirect acting carcinogens and likely overestimates potential risk by a factor of 6 to 12 depending on the study species (USEPA, 1992e). Further assumptions for dose conversions involve standardized scaling factors to account for differences between humans and experimental animals with respect to life span, body size, breathing rates, and other physiological parameters. In addition, evaluation of risks associated with one route of administration (e.g., inhalation) when tests in animals involve a different route (e.g., ingestion) requires additional assumptions with corresponding additional uncertainties. Although USEPA has formally changed its default position for scaling animal data to humans from a per surface area to a per body weight basis (USEPA, 1992e), changes to existing CSF

will only be made when the USEPA commits to a formal review of a constituent's dose-response profile, and as of this writing, few have been incorporated.

High-to-Low Dose Extrapolation

The concentration of constituents to which people are potentially exposed at industrial sites is usually much lower than the levels used in the studies from which dose-response relationships are developed. Estimating potential health effects at such sites, therefore, requires the use of models that allow extrapolation of health effects from high experimental doses in animals to low environmental doses. These models are generally statistical in character and have little or no biological basis. Thus the use of a model for dose extrapolation introduces uncertainty in the dose-response estimate. In addition, these models contain assumptions that may also introduce a large amount of uncertainty. Generally the models have been developed to err on the side of over-estimating rather than under-estimating potential health risks.

The USEPA CSFs are derived using the upper 95% confidence limit of the slope predicted by the linearized multi-stage (LMS) model used to extrapolate low dose risk from high dose experimental data. USEPA recognizes that this method produces very conservative risk estimates, and that other mathematical models exist. USEPA states that the upper-bound estimate generated by the LMS model leads to a plausible upper limit to the risk that is consistent with some of the proposed mechanisms of carcinogenesis. The true risk, however, is unknown and may be as low as zero. The LMS model is very conservative as it assumes strict linearity between the lowest dose that produced an effect and zero dose. However, the body has many mechanisms to detoxify constituents, especially at low doses, and many mechanisms to repair damages if they should occur. Therefore, many scientists believe that most constituents can cause cancer only above a "threshold" dose. This phenomenon of a threshold for carcinogenic activity has recently been demonstrated for chloroform (as reviewed in Bradley, 1996).

An established policy does not yet exist for using "most likely" or "best" estimates of risk within the range of uncertainty defined by the upper- and lower-limit estimates defined by the models. USEPA has published a draft version of its cancer guidelines (USEPA, 1996c). These draft guidelines allow for much greater use of mechanistic data, however, the guidelines have not yet been finalized and it will take time before USEPA can apply the new methodology to existing CSF.

6.4.3 Exposure Assessment

Exposure assessment consists of three basic steps: 1) development of exposure scenarios, (2) estimation of exposure point concentrations, and 3) estimation of human dose.

Exposure Scenarios

Exposure scenarios in a risk assessment are selected to be representative of potential exposures to COPCs in media that may be experienced by human receptors based on current and reasonably foreseeable land use. These exposure scenarios are developed for a hypothetical receptor, but one that would represent the RME scenario for the site. Therefore, exposure levels are assumed for these receptors (recreational and construction in this case), that are much greater than expected to occur in an actual population. The use of the MLE scenarios provides an estimate of exposures more likely to represent average exposures. The MLE risk estimates are used to put the RME risk estimates into context.

Estimation of Exposure Point Concentrations

Sample Statistics. Exposure to COPCs at the site is best estimated by the use of the arithmetic mean concentration of a COPC in each medium. Because of the uncertainty associated with estimating the true average concentration at a site, the USEPA has required the use of the 95% UCL on the arithmetic mean as the EPC (USEPA, 1992a). Therefore, this is a very conservative estimate of the true arithmetic mean. RME EPCs in this risk assessment represent the lower of the maximum detected concentration or the 95% UCL on the mean (USEPA, 1992a). The appropriate UCL is selected based on the results of a Shapiro-Wilk Test for Normality, the results of which indicate whether a data set is more likely to be normally or lognormally distributed. Uncertainty can arise if the test results show the data set to be normally distributed when it is actually lognormally distributed, or vice-versa. This source of uncertainty, however, would not lead to large differences in the calculated dose for a given receptor, based on a comparison of the two UCL values calculated for this risk assessment. Again to provide context, the MLE calculations have used the arithmetic mean concentration, not the upper bound, as the EPC.

Sample Location. In addition, the data used to calculate the EPCs are assumed to be representative of general site conditions. Sample locations in the sites and transects were identified to be as representative of site conditions as possible.

Environmental Degradation. Finally, it is assumed that the EPCs calculated in the risk assessment based on current site conditions remain constant for the assumed exposure duration – for the recreational scenario evaluated in this risk assessment, this is a period of 11 years, and for the construction scenario, exposure could occur at any time in the future. However, it is well known in the scientific community that constituents in the environment are subject to natural attenuation and biodegradation processes. Organic constituents are naturally degraded in the environment by a variety of processes (i.e., photodegradation, microbial activity, hydrolysis, etc.). USEPA has recognized the validity and utility of natural attenuation and biodegradation as a remedial option and has recently published guidance for its site-specific implementation (USEPA, 1997d). Environmental half-lives vary for specific constituents based on environmental conditions (i.e., presence of bacteria,

pH, exposures to sunlight and oxygen), and there are respected literature sources of such information. However, environmental degradation is not typically accounted for in the calculation of risks for the site. This has likely resulted in an over-estimation of site risks.

Exposure Assumptions

When estimating potential human doses (i.e., intakes) from potential exposure to various media containing COPCs, several assumptions are made. Uncertainty may exist, for example, in assumptions concerning rates of ingestion, frequency and duration of exposure, and bioavailability of the constituents in the medium. Typically, when limited information is available to establish these assumptions, a conservative (i.e., health-protective) estimate of potential exposure is employed. Default exposure assumptions recommended by the USEPA are intended to be conservative and representative of an individual who consistently and frequently contacts environmental media at a site, a scenario that rarely occurs. Most individuals will contact media at non-site locations, while the risk assessment assumes that all exposure to environmental media will occur at the site. Moreover, it is often assumed that contact with environmental media occurs in the areas having the highest constituent concentrations for the entire exposure frequency/duration used in the risk assessment, due to both statistical handling of the data and the original sampling plan. The use of conservative assumptions is likely to lead to an overestimate of potential risk.

6.4.4 Risk Characterization

The potential risk of adverse human health effects is characterized based on estimated potential exposures and potential dose-response relationships. Three areas of uncertainty are introduced in this phase of the risk assessment: the evaluation of potential exposure to multiple constituents, the combination of upper-bound exposure estimates with upper-bound toxicity estimates, and the risk to sensitive populations.

6.4.5 Risk from Multiple Constituents

Once potential exposure to and potential risk from each COPC is estimated, the total upper-bound potential risk posed by the site is determined by combining the estimated potential health risk from each of the COPC. Presently, potential carcinogenic effects are added unless evidence exists indicating that the COPC interact synergistically (a combined effect that is greater than a simple addition of potential individual effects) or antagonistically (a combined effect that is less than a simple addition of potential individual effects) with each other. For most combinations of constituents, little if any evidence of interaction is available. Therefore, additivity is assumed. Although the IEPA TACO program provides a listing of groups of constituents that are considered to be additive in their carcinogenic potential, the USEPA approach of assuming additivity across all constituents was used in this risk assessment.

For noncarcinogenic effects, the HI should only be summed for constituents that have the same or similar toxic endpoints (USEPA, 1989a). The toxic endpoint is defined as the most sensitive noncarcinogenic health effect used to derive the RfD or other suitable toxicity value (USEPA, 1989a). Again, there is little evidence to suggest whether those COPCs associated with a common toxicity endpoint are additive, synergistic, antagonistic, or independent in terms of mechanism of action. Whether assuming additivity leads to an underestimation or overestimation of risk is unknown.

Combination of Several Upper-Bound Assumptions

Generally, the goal of a risk assessment is to estimate an upper-bound, but reasonable, potential exposure and risk. Most of the assumptions about exposure and toxicity used in this evaluation are representative of statistical upper-bounds or even maxima for each parameter. The result of combining several such upper-bound assumptions is that the final estimate of potential exposure or potential risk is extremely conservative (health-protective).

This is best illustrated by a simple example. Assume that potential risk depends upon three variables (soil consumption rate, COPC concentration in soil and CSF). The mean, upper 95% bound and maximum are available for each variable.

One way to generate a conservative estimate of potential risk is to multiply the upper 95% bounds of the three parameters in this example. Doing so assumes that the 5% of the people who are most sensitive to the potential carcinogenic effects of a COPC will also ingest soil at a rate that exceeds the rate for 95% of the population, and that all the soil these people eat will have a compound concentration that exceeds the concentration in 95% of the soil on site. The consequence of these assumptions is that the estimated potential risk is representative of 0.0125% of the population ($0.05 \times 0.05 \times 0.05 = 0.000125 \times 100 = 0.0125\%$). Put another way, these assumptions overestimate risks for 9,999 out 10,000 people, or 99.99% of the population. Thus, the majority of people will have a much lower level of potential risk. The very conservative nature of the potential risks estimated by the risk assessment process is not generally recognized. In reality, the estimates are more conservative than outlined above, because usually more than three upper 95% assumptions are used to estimate potential risk(s).

Alternatively, if a single upper 95% assumption of the cancer slope factor is combined with average (50th percentile) assumptions for soil concentration and soil ingestion rate, the resulting estimates of potential risk still overpredict risk for 99% of the potentially exposed population. This is a conservative and health protective approach that substantially overestimates the "average" level and even the reasonable maximum level of potential risk.

The risk assessment approach used here employed upper 95% bounds or maxima for most RME exposure and toxicity assumptions. Thus, it produces estimates of potential risk two to three orders of

magnitude greater than the risk experienced by the average member of the potentially exposed populations. The MLE scenarios have used average estimates of exposure where possible, but still use the conservative toxicity values, thus even the MLE risk estimates are likely to overestimate total risk.

6.4.6 Risk to Sensitive Populations

The health risks estimated in the risk characterization generally apply to the receptors whose activities and locations were described in the exposure assessment. Some people will always be more sensitive than the average person and, therefore, will be at greater risk. Dose-response values used to calculate risk, however, are frequently derived to account for additional sensitivity of subpopulations (e.g., the uncertainty factor of 10 used to account for intraspecies differences). Therefore, it is unlikely that this source of uncertainty contributes significantly to the overall uncertainty of the risk assessment.

6.4.7 Summary of Sources of Uncertainty in Human Health Risk Assessment

The large number of assumptions made in the risk characterization introduces uncertainty in the results. While this could potentially lead to underestimates of potential risk, the use of numerous conservative (i.e., protective of human health) assumptions, as was done here, results in overestimates of potential risks. Any one person's potential exposure and subsequent risk are influenced by all the parameters mentioned above and will vary on a case-by-case basis. Despite inevitable uncertainties associated with the steps used to derive potential risks, the use of numerous health-protective assumptions will most likely lead to a very large overestimate of potential risks from the site. Moreover, when evaluating risk assessment results, it is important to put the risks into perspective. For example, the background rate of cancer in the US is approximately 2,500 for a population of 10,000 people (Landis, et al., 1998). The results of the risk assessment must be carefully interpreted considering the uncertainty and conservatism associated with the analysis, especially where site management decisions are made.

TABLE 6-1
 TOTAL POTENTIAL CARCINOGENIC RISK
 RECREATIONAL TEEN
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	RME					MLE				
	CS-B	CS-D	CS-E	CS-F	SITE M	CS-B	CS-D	CS-E	CS-F	SITE M
1,4-Dichlorobenzene	1.88E-10	NC	NC	NC	2.82E-09	5.89E-11	NC	NC	NC	1.97E-10
4-Nitroaniline	NC									
Arsenic	1.30E-07	2.06E-07	1.26E-07	1.30E-07	1.31E-07	2.96E-08	3.47E-08	2.46E-08	2.95E-08	2.21E-08
Benzo(a)anthracene	2.04E-09	NC	NC	NC	NC	8.11E-10	NC	NC	NC	NC
Benzo(a)pyrene	1.30E-08	1.69E-08	1.31E-08	9.65E-09	5.81E-08	5.21E-09	4.06E-09	4.29E-09	3.33E-09	1.01E-08
Benzo(b)fluoranthene	1.94E-09	NC	NC	NC	NC	7.45E-10	NC	NC	NC	NC
Bis(2-ethylhexyl)phthalate	1.25E-10	NC	NC	NC	NC	1.71E-10	NC	NC	NC	NC
Copper	NC									
Dibenzo(a,h)anthracene	9.23E-09	NC	9.16E-09	NC	1.81E-08	3.45E-09	NC	3.32E-09	NC	3.88E-09
Dieldrin	4.10E-09	3.16E-07	NC	NC	NC	1.03E-09	1.71E-08	NC	NC	NC
Heptachlor	NC	NC	NC	NC	1.29E-08	NC	NC	NC	NC	1.02E-09
Heptachlor epoxide	3.18E-09	NC	NC	NC	2.24E-07	1.09E-09	NC	NC	NC	8.38E-09
Pentachlorophenol	9.10E-10	NC	NC	NC	NC	9.92E-10	NC	NC	NC	NC
2,3,7,8-TCDD TEQ	1.65E-06	NC	NC	NC	2.76E-05	5.46E-07	NC	NC	NC	2.26E-06
Total PCBs	1.36E-07	1.91E-07	2.11E-08	NC	1.94E-06	8.11E-08	1.44E-08	5.46E-09	NC	1.58E-07
Total Risk	1.95E-06	7.30E-07	1.69E-07	1.40E-07	3.00E-05	6.70E-07	7.02E-08	3.77E-08	3.29E-08	2.46E-06

Notes:
 CS - Creek Segment.
 MLE - Most Likely Exposure.
 NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area.
 RME - Reasonable Maximum Exposure.

TABLE 6-2
 TOTAL POTENTIAL HAZARD INDEX
 RECREATIONAL TEEN
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	RME					MLE				
	CS-B	CS-D	CS-E	CS-F	SITE M	CS-B	CS-D	CS-E	CS-F	SITE M
1,4-Dichlorobenzene	1.66E-06	NC	NC	NC	2.49E-05	5.20E-07	NC	NC	NC	1.74E-06
4-Nitroaniline	NC									
Arsenic	1.84E-03	2.91E-03	1.78E-03	1.84E-03	1.86E-03	4.18E-04	4.90E-04	3.48E-04	4.18E-04	3.13E-04
Benzo(a)anthracene	NC									
Benzo(a)pyrene	NC									
Benzo(b)fluoranthene	NC									
Bis(2-ethylhexyl)phthalate	2.83E-06	NC	NC	NC	NC	3.89E-06	NC	NC	NC	NC
Copper	4.75E-03	NC	4.64E-03	NC	2.09E-02	5.36E-04	NC	4.71E-04	NC	1.59E-03
Dibenzo(a,h)anthracene	NC									
Dieldrin	3.26E-05	2.52E-03	NC	NC	NC	8.22E-06	1.36E-04	NC	NC	NC
Heptachlor	NC	NC	NC	NC	3.65E-05	NC	NC	NC	NC	2.88E-06
Heptachlor epoxide	1.71E-04	NC	NC	NC	1.21E-02	5.85E-05	NC	NC	NC	4.51E-04
Pentachlorophenol	1.61E-06	NC	NC	NC	NC	1.75E-06	NC	NC	NC	NC
2,3,7,8-TCDD TEQ	NC									
Total PCBs	2.16E-02	3.03E-02	3.36E-03	NC	3.08E-01	1.29E-02	2.28E-03	8.68E-04	NC	2.51E-02
Total HI	2.84E-02	3.58E-02	9.78E-03	1.84E-03	3.43E-01	1.39E-02	2.91E-03	1.69E-03	4.18E-04	2.75E-02

Notes:

CS - Creek Segment.

HI - Hazard Index.

HQ - Hazard Quotient.

MLE - Most Likely Exposure.

NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area.

RME - Reasonable Maximum Exposure.

TABLE 6-3
 TOTAL POTENTIAL CARCINOGENIC RISK
 CONSTRUCTION WORKER
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	RME					MLE				
	CS-B	CS-D	CS-E	CS-F	SITE M	CS-B	CS-D	CS-E	CS-F	SITE M
1,4-Dichlorobenzene	1.96E-11	NC	NC	NC	2.94E-10	7.66E-12	NC	NC	NC	2.56E-11
4-Nitroaniline	NC									
Arsenic	1.27E-08	2.01E-08	1.23E-08	1.27E-08	1.28E-08	3.67E-09	4.31E-09	3.06E-09	3.67E-09	2.75E-09
Benzo(a)anthracene	2.64E-10	NC	NC	NC	NC	1.18E-10	NC	NC	NC	NC
Benzo(a)pyrene	1.68E-09	2.19E-09	1.69E-09	1.25E-09	7.51E-09	7.59E-10	5.91E-10	6.25E-10	4.84E-10	1.46E-09
Benzo(b)fluoranthene	2.51E-10	NC	NC	NC	NC	1.08E-10	NC	NC	NC	NC
Bis(2-ethylhexyl)phthalate	1.23E-11	NC	NC	NC	NC	2.14E-11	NC	NC	NC	NC
Copper	NC									
Dibenzo(a,h)anthracene	1.19E-09	NC	1.18E-09	NC	2.35E-09	5.02E-10	NC	4.83E-10	NC	5.64E-10
Dieldrin	4.27E-10	3.29E-08	NC	NC	NC	1.34E-10	2.22E-09	NC	NC	NC
Heptachlor	NC	NC	NC	NC	1.34E-09	NC	NC	NC	NC	1.32E-10
Heptachlor epoxide	3.31E-10	NC	NC	NC	2.33E-08	1.42E-10	NC	NC	NC	1.09E-09
Pentachlorophenol	9.48E-11	NC	NC	NC	NC	1.29E-10	NC	NC	NC	NC
2,3,7,8-TCDD TEQ	2.22E-07	NC	NC	NC	3.71E-06	8.07E-08	NC	NC	NC	3.34E-07
Total PCBs	1.68E-08	2.36E-08	2.62E-09	NC	2.40E-07	1.16E-08	2.05E-09	7.80E-10	NC	2.25E-08
Total Risk	2.56E-07	7.89E-08	1.78E-08	1.40E-08	4.00E-06	9.78E-08	9.17E-09	4.94E-09	4.16E-09	3.62E-07

Notes:
 CS - Creek Segment.
 MLE - Most Likely Exposure.
 NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area.
 RME - Reasonable Maximum Exposure.

TABLE 6-4
 TOTAL POTENTIAL HAZARD INDEX
 CONSTRUCTION WORKER
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	RME					MLE				
	CS-B	CS-D	CS-E	CS-F	SITE M	CS-B	CS-D	CS-E	CS-F	SITE M
1,4-Dichlorobenzene	1.90E-06	NC	NC	NC	2.85E-05	7.45E-07	NC	NC	NC	2.49E-06
4-Nitroaniline	NC									
Arsenic	1.98E-03	3.13E-03	1.91E-03	1.98E-03	2.00E-03	5.72E-04	6.70E-04	4.75E-04	5.71E-04	4.28E-04
Benzo(a)anthracene	NC									
Benzo(a)pyrene	NC									
Benzo(b)fluoranthene	NC									
Bis(2-ethylhexyl)phthalate	3.07E-06	NC	NC	NC	NC	5.35E-06	NC	NC	NC	NC
Copper	5.03E-03	NC	4.91E-03	NC	2.21E-02	7.24E-04	NC	6.36E-04	NC	2.15E-03
Dibenzo(a,h)anthracene	NC									
Dieldrin	3.74E-05	2.88E-03	NC	NC	NC	1.18E-05	1.94E-04	NC	NC	NC
Heptachlor	NC	NC	NC	NC	4.18E-05	NC	NC	NC	NC	4.12E-06
Heptachlor epoxide	1.96E-04	NC	NC	NC	1.38E-02	8.38E-05	NC	NC	NC	6.45E-04
Pentachlorophenol	1.84E-06	NC	NC	NC	NC	2.51E-06	NC	NC	NC	NC
2,3,7,8-TCDD TEQ	NC									
Total PCBs	2.94E-02	4.14E-02	4.58E-03	NC	4.20E-01	2.03E-02	3.59E-03	1.37E-03	NC	3.95E-02
Total HI	3.67E-02	4.74E-02	1.14E-02	1.98E-03	4.58E-01	2.17E-02	4.46E-03	2.48E-03	5.71E-04	4.27E-02

Notes:
 CS - Creek Segment.
 HI - Hazard Index.
 HQ - Hazard Quotient.
 MLE - Most Likely Exposure.
 NC - Not Calculated, no dose-response value or not a constituent of potential concern in this area.
 RME - Reasonable Maximum Exposure.

7.0 SUMMARY AND CONCLUSIONS

This report has presented the baseline HHRA for creek bottom soils in Dead Creek Segments B-F and Site M, Sauget Area 1, located in Sauget and Cahokia, Illinois.

The HHRA was conducted in accordance with the USEPA-approved HHRA Workplan dated June 25, 1999 (including the August 6, 1999 revised pages), which was submitted as Volume 1B of the SSP for Sauget Area 1 (Solutia, 1999), as well as Appendix A to the USEPA-approved HHRA for Sauget Area 1 dated June 1, 2001 (including the August 31, 2001 revised pages) (Solutia, 2001).

The HHRA was conducted using data from environmental creek bottom soil samples collected from the study area after the UAO sediment removal action (shown in Figure 1-1 and described in more detail in Section 2) in accordance with the USEPA-approved SSP. Dead creek bottom soil and its environs including creek segments CS-B, CS-C, CS-D, CS-E, and CS-F, and Site M were evaluated.

Background or reference sediment samples collected as part of the original SSP effort (Solutia, 1999) were used in this evaluation. The SSP identified the suites of analytes for each medium. The analytes included in the risk assessment are: VOCs, SVOCs, metals, mercury, cyanide, PCBs, pesticides, herbicides, and dioxins.

The baseline HHRA has been conducted in accordance with the four-step paradigm for human health risk assessments developed by USEPA (USEPA, 1989a); these steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

The risk assessment results are summarized by step below.

7.1 Data Evaluation and Hazard Identification

The purpose of the data evaluation and hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of these constituents identified as COPCs for quantitative evaluation in the risk assessment. This step of the risk assessment involves compiling and summarizing the data for the risk assessment, and selecting COPCs based on a series of screening steps. Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status.

Per the HHRA Workplan (Solutia, 1999), IEPA TACO Tier I criteria (IEPA, 1998) were used for the identification of COPCs for creek bottom soil for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria were not available, USEPA Region 9 PRGs (2000b) were used. Residential values were used to identify COPCs for creek bottom soils.

Background samples were collected in the vicinity of the site to provide information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons were conducted for each medium using site-specific background data.

The procedure for determining whether a constituent concentration is consistent with background follows that developed by USEPA Region 4 (USEPA, 2000a) and presented in the HHRA Workplan (Solutia, 1999). Maximum detected concentrations of constituents in environmental media at the site were compared to two times the arithmetic mean site-specific background concentration. Therefore, if maximum concentrations of constituents in an area are found to be less than two times the average background concentrations, then those constituents are eliminated from quantitative evaluation in the risk assessment.

In the screening process, constituents in an area with maximum concentrations less than or equal to the screening criteria were not included as COPCs. Where no COPCs are identified for an area, that area was not evaluated quantitatively in the HHRA.

Sixteen COPCs were identified in creek bottom soil, as shown in Table 3-1.

7.2 Dose-Response Assessment

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response) (USEPA, 1989a). Adverse effects are classified by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA for oral exposure and for exposure by inhalation. Oral toxicity values are also used to assess dermal exposures, with appropriate adjustments, because USEPA has not yet developed values for this route of exposure. Combining the results of the toxicity assessment with information on the magnitude of potential human exposure provides an estimate of potential risk.

Sources of the published toxicity values in this risk assessment include USEPA's Integrated Risk Information System (IRIS) (USEPA, 2002a), the Health Effects Assessment Summary Tables (HEAST)

(USEPA, 1997b), and the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio.

Risks were calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the TEFs provided by WHO (Van den Berg et al., 1998), presented in Table 4-4. The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD.

7.3 Exposure Assessment

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios identifying appropriate environmental media and exposure pathways for current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPCs are identified and are judged to be complete are evaluated quantitatively in the risk assessment.

7.3.1 Conceptual Site Model

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a CSM for human health was developed. The purpose of the CSM is to identify source areas, potential migration pathways of constituents from source areas to environmental media where exposure can occur, and to identify potential human receptors.

The CSM for the Sauget Area 1 risk assessment is presented in Figure 5-1. The CSM identifies potential sources, constituent migration pathways from one medium to another, and potential exposure pathways (e.g., creek bottom soil), potential exposure routes (e.g., ingestion, dermal contact), and potential receptors (e.g., recreational teen, construction worker).

Creek bottom soil samples were collected and analyzed from creek segments B-F of Dead Creek and Site M. The sampling program was developed to provide data to evaluate potential human health effects of chronic daily exposures to constituents detected in samples of creek bottom soil remaining after excavation.

7.3.2 Exposure Point Concentrations

Exposure points are located where potential receptors may contact COPCs at or from the site. The concentration of COPCs in the environmental medium that receptors may contact must be estimated in

order to determine the magnitude of potential exposure. Both measured and modeled EPCs have been used in this risk assessment.

The EPC for a human health risk assessment is defined as the 95% UCL on the arithmetic mean concentration, or the maximum concentration, whichever is lower (U.S. EPA, 1992a), for the RME scenario and the arithmetic mean concentration for the MLE scenario. Summary statistics have been calculated for each COPC in each medium, as presented in Attachment A. Calculation of the 95% UCL is dependent upon the distribution of the data set. The 95% UCL calculations were conducted as described by USEPA (1992a).

The exposure point concentrations for each COPC in creek bottom soil are presented in Section 5 tables for both the RME and MLE scenarios.

7.3.3 Receptor Evaluation

Table 5-1 presents the receptor/pathway/area matrix that summarizes the receptors evaluated in each area, by medium and exposure route. These scenarios were developed based on the data, the CSM, and the COPCs identified in each medium. RME scenarios and MLE scenarios based on appropriate USEPA guidance were both evaluated in the quantitative risk assessment. In all, two receptor scenarios (recreational teenager, construction worker) were evaluated in the Sauget Area 1 Creek Bottom Soils risk assessment.

To estimate the potential risk to human health that may be posed by the presence of COPCs in environmental media in the study area, it is first necessary to estimate the potential exposure dose of each COPC for each receptor. The exposure dose is estimated for each constituent via each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day). The exposure doses are combined with the toxicity values to estimate potential risks and hazards for each receptor. The exposure dose and risk calculation spreadsheets are presented in Attachment F.

7.4 Risk Characterization Methodology

The potential risk to human health associated with potential exposure to COPCs in environmental media at the site is evaluated in this step of the risk assessment process. Risk characterization is the process in which the dose-response information (Section 4.0) is integrated with quantitative estimates of human exposure derived in the Exposure Assessment (Section 5.0). The result is a quantitative estimate of the likelihood that humans will experience any adverse health effects given the exposure assumptions made. Two general types of health risk are characterized for each

potential exposure pathway considered: potential carcinogenic risk and potential noncarcinogenic risk. Carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (1989a), is assumed to be 70 years. Noncarcinogenic risk is evaluated by averaging exposure over the total exposure period.

Characterization of the potential impact of potential carcinogenic and noncarcinogenic constituents is approached in very different ways. The difference in approaches arises from the conservative assumption that substances with possible carcinogenic action proceed by a no-threshold mechanism, whereas other toxic actions may have a threshold, a dose below which few individuals would be expected to respond. Thus, under the no-threshold assumption, it is necessary to calculate a risk, but for constituents with a threshold, it is possible to simply characterize an exposure as above or below the threshold. In risk assessment, that threshold is termed an RfD.

7.4.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a constituent in environmental media at the site. This likelihood is a function of the dose of a constituent (described in the Exposure Assessment, Section 5.0) and the CSF (described in the Toxicity Assessment, Section 4.0) for that constituent. The ELCR is the likelihood over and above the background cancer rate, which currently in the U.S. is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., 10^{-6} , or one in one million). The ELCR is calculated using the following equation:

$$\text{ELCR} = \text{LADD}(\text{mg/kg - day}) \times \text{CSF}(\text{mg/kg - day})^{-1}$$

The potential carcinogenic risk for each exposure pathway is calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks were summed to estimate the total site potential cancer risk for each receptor. A summary of the total site cancer risks for each receptor group were presented in Section 6.0 and compared to the USEPA's target risk range of 10^{-4} to 10^{-6} . As indicated in Table 7-1, no exceedances of this risk range were identified.

The target risk levels are based on USEPA guidance and Illinois TACO guidance. Specifically, USEPA provides the following guidance (USEPA, 1991a):

"Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} , and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." and,

"The upper boundary of the risk range is not a discrete line at 1×10^{-4} , although EPA generally uses 1×10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions."

IEPA provides the following summary for the evaluation of cumulative risk for carcinogens (IEPA, 1998, Fact Sheet 13: Mixture Rule):

"The cumulative risk of carcinogenic contaminants attacking the same target must not exceed 1 in 10,000 [10^{-4}]. Therefore, the risk from all on-site similar acting carcinogens must be added together. If this cumulative risk level is greater than 1 in 10,000, corrective action must be taken to reach an acceptable risk level."

7.4.2 Non-Carcinogenic Risk Characterization

The potential for exposure to a constituent to result in adverse noncarcinogenic health effects is estimated for each receptor by comparing the Chronic Average Daily Dose (CADD) for each COPC with the RfD for that COPC. The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that constituent. The HQ is calculated using the following equation:

$$HQ = \frac{CADD\text{ (mg/kg - day)}}{RfD\text{ (mg/kg - day)}}$$

The target HQ is defined as an HQ of less than or equal to one (USEPA, 1989a). When the HQ is less than or equal to 1, the RfD has not been exceeded, and no adverse noncarcinogenic effects are expected. If the HQ is greater than 1, there may be a potential for adverse noncarcinogenic health effects to occur; however, the magnitude of the HQ cannot be directly equated to a probability or effect level. HQs for a given pathway are summed to provide a hazard Index (HI). Pathway HIs are summed to provide a total receptor HI. When the HI is less than 1, the target has not been exceeded, and no adverse noncarcinogenic effects are expected. This initial HI summation assumes that all the COPCs are additive in their toxicity, and is considered only a screening step as additive toxicity may not be correct. If the HI is greater than 1, further evaluation is necessary to determine if the COPCs are additive in toxicity. This evaluation is termed a toxic endpoint analysis. As indicated in Table 7-1, no exceedances of the target HI of one were identified. Therefore, a toxic endpoint analysis was not performed.

7.5 Summary

Based on the results of this baseline risk assessment for Sauget Area 1 Creek Bottom Soils, it is recommended that no further remedial action is necessary for segments B-F of Dead Creek and Site M. Potential carcinogenic risks are within the target risk range for all areas and the Hazard Index for

each area is below 1 for both the recreational teenager and the construction worker, as shown in Tables 7-1 and 7-2.

TABLE 7-1
SUMMARY OF POTENTIAL RISK AND HAZARD INDICES - RECREATIONAL TEENAGER
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	Potential Risk		Hazard Index	
	RME	MLE	RME	MLE
CS-B	1.95E-06	6.70E-07	2.84E-02	1.39E-02
CS-D	7.30E-07	7.02E-08	3.58E-02	2.91E-03
CS-E	1.69E-07	3.77E-08	9.78E-03	1.69E-03
CS-F	1.40E-07	3.29E-08	1.84E-03	4.18E-04
Site M	3.00E-05	2.46E-06	3.43E-01	2.75E-02

Notes:
 MLE - Maximum Likely Exposure.
 RME - Reasonable Maximum Exposure.

TABLE 7-2
 SUMMARY OF POTENTIAL RISK AND HAZARD INDICES - CONSTRUCTION WORKER
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Area	Potential Risk		Hazard Index	
	RME	MLE	RME	MLE
CS-B	2.56E-07	9.78E-08	3.67E-02	2.17E-02
CS-D	7.89E-08	9.17E-09	4.74E-02	4.46E-03
CS-E	1.78E-08	4.94E-09	1.14E-02	2.48E-03
CS-F	1.40E-08	4.16E-09	1.98E-03	5.71E-04
Site M	4.00E-06	3.62E-07	4.58E-01	4.27E-02

Notes:
 MLE - Maximum Likely Exposure.
 RME - Reasonable Maximum Exposure.

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Attachment A

Summary Statistics and Calculation of Total PCBs and TCDD-TEQ

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	(t-test) Norm	H-test (Lognorm)	UCL (b)			
Creek Segment B										
1,1,1-Trichloroethane	3 : 48 : 49	0.3131	0.6189	LOGNORM	0.0048	0.0044	0.0044	0.0230	0.0042	0.0044
1,2,4-Trichlorobenzene	6 : 49 : 49	0.2001	0.3619	LOGNORM	5.1315	0.4947	0.4947	80.0000	2.2752	0.4947
1,2-Dichlorobenzene	6 : 49 : 49	0.2114	0.3445	LOGNORM	3.6277	0.4879	0.4879	53.0000	1.6710	0.4879
1,2-Dichloroethene (total)	1 : 48 : 49	0.4956	0.7570	LOGNORM	0.0042	0.0040	0.0040	0.0120	0.0039	0.0040
1,3-Dichlorobenzene	1 : 4 : 49	0.0000	0.0000	NORMAL				0.1000	0.1000	0.1000
1,4-Dichlorobenzene	7 : 49 : 49	0.2588	0.4997	LOGNORM	0.4931	0.2735	0.2735	5.5000	0.2931	0.2735
2,3,7,8-TCDD-TEQ	49 : 49 : 49	0.2922	0.8891	LOGNORM	0.0005	0.0003	0.0003	0.0066	0.0003	0.0003
2,4,5-T	12 : 48 : 49	0.2112	0.5566	LOGNORM	0.0435	0.0140	0.0140	0.6100	0.0220	0.0140
2,4,5-TP (Silvex)	3 : 3 : 49	0.8710	0.8553	NORMAL				0.0020	0.0018	0.0020
2,4,5-Trichlorophenol	1 : 49 : 49	0.5403	0.6863	LOGNORM	0.1246	0.1234	0.1234	0.2400	0.1199	0.1234
2,4,6-Trichlorophenol	5 : 49 : 49	0.1976	0.3721	LOGNORM	0.3063	0.1150	0.1150	4.3000	0.1580	0.1150
2,4-D	3 : 47 : 49	0.1959	0.3813	LOGNORM	0.0139	0.0084	0.0084	0.1400	0.0091	0.0084
2,4-DB	2 : 47 : 49	0.2859	0.4237	LOGNORM	0.0087	0.0078	0.0078	0.0670	0.0076	0.0078
2,4-Dichlorophenol	5 : 49 : 49	0.1826	0.3857	LOGNORM	0.4917	0.2066	0.2066	6.6000	0.2692	0.2066
2-Butanone (MEK)	29 : 48 : 49	0.2858	0.8816	LOGNORM	0.0560	0.0362	0.0362	0.6100	0.0350	0.0362
2-Chlorophenol	3 : 49 : 49	0.2732	0.4551	LOGNORM	0.1382	0.1299	0.1299	0.5100	0.1246	0.1299
2-Hexanone	1 : 48 : 49	0.4223	0.7143	LOGNORM	0.0220	0.0209	0.0209	0.0770	0.0198	0.0209
2-Methylnaphthalene	3 : 49 : 49	0.2290	0.3343	LOGNORM	0.6332	0.2761	0.2761	7.3000	0.3531	0.2761
3&4Methylphenol	1 : 49 : 49	0.1737	0.2968	LOGNORM	0.1984	0.1465	0.1465	1.6000	0.1477	0.1465
4,4'-DDD	3 : 49 : 49	0.2259	0.5955	LOGNORM	0.0322	0.0113	0.0113	0.4700	0.0160	0.0113
4,4'-DDE	2 : 44 : 49	0.3186	0.5171	LOGNORM	0.0049	0.0037	0.0037	0.0350	0.0036	0.0037
4,4'-DDT	15 : 48 : 48	0.5753	0.8010	LOGNORM	0.0261	0.0283	0.0283	0.1600	0.0183	0.0283
4-Chloroaniline	5 : 49 : 49	0.2353	0.4110	LOGNORM	1.0292	0.5142	0.5142	11.0000	0.5842	0.5142
4-Methyl-2-pentanone (MIBK)	5 : 48 : 49	0.3485	0.6825	LOGNORM	0.0238	0.0214	0.0214	0.1100	0.0203	0.0214
4-Nitroaniline	2 : 49 : 49	0.1758	0.3193	LOGNORM	1.0470	0.7436	0.7436	9.0000	0.7588	0.7436
4-Nitrophenol	1 : 1 : 49		NA					0.4400	0.4400	0.4400
Acenaphthene	2 : 49 : 49	0.2275	0.4421	LOGNORM	0.1573	0.1369	0.1369	0.8600	0.1317	0.1369
Acenaphthylene	1 : 49 : 49	0.5677	0.7108	LOGNORM	0.1251	0.1239	0.1239	0.2400	0.1203	0.1239
Acetone	38 : 48 : 49	0.7852	0.9543	LOGNORM	0.1437	0.1649	0.1649	0.4700	0.1159	0.1649
Aldrin	1 : 1 : 49		NA					0.0004	0.0004	0.0004
alpha-BHC	9 : 44 : 49	0.5944	0.7705	LOGNORM	0.0007	0.0007	0.0007	0.0029	0.0006	0.0007
Aluminum	49 : 49 : 49	0.9749	0.8768	NORMAL	10313.5320	11466.9695	10313.5320	20000.0000	9348.9796	10313.5320
Anthracene	4 : 49 : 49	0.2361	0.5058	LOGNORM	0.1921	0.1518	0.1518	1.4000	0.1477	0.1518
Antimony	4 : 46 : 49	0.7202	0.8404	LOGNORM	1.5960	1.5773	1.5773	3.9000	1.4480	1.5773
Arsenic	49 : 49 : 49	0.7508	0.9674	LOGNORM	11.4435	11.3981	11.3981	44.0000	9.7194	11.3981
Barium	49 : 49 : 49	0.4780	0.8729	LOGNORM	343.3508	323.7707	323.7707	1500.0000	298.1429	323.7707
Benzene	19 : 49 : 49	0.2067	0.5600	LOGNORM	0.0144	0.0068	0.0068	0.1800	0.0083	0.0068
Benzo(a)anthracene	4 : 49 : 49	0.2564	0.4691	LOGNORM	0.2344	0.1690	0.1690	1.9000	0.1693	0.1690
Benzo(a)pyrene	7 : 49 : 49	0.3016	0.4787	LOGNORM	0.1562	0.1073	0.1073	1.2000	0.1089	0.1073
Benzo(b)fluoranthene	6 : 49 : 49	0.2849	0.5233	LOGNORM	0.2038	0.1603	0.1603	1.4000	0.1557	0.1603
Benzo(g,h,i)perylene	6 : 49 : 49	0.2941	0.5022	LOGNORM	0.1653	0.1450	0.1450	0.8900	0.1379	0.1450
Benzo(k)fluoranthene	5 : 49 : 49	0.3056	0.4861	LOGNORM	0.1845	0.1559	0.1559	0.9000	0.1487	0.1559
Beryllium	38 : 49 : 49	0.9537	0.9086	NORMAL	0.6098	0.8450	0.6098	1.3000	0.5386	0.6098

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	t-test Norm	H-test (Lognorm)	UCL (b)			
beta-BHC	10 : 46 : 49	0.5693	0.6910	LOGNORM	0.0017	0.0015	0.0015	0.0077	0.0013	0.0015
Bis(2-ethylhexyl)phthalate	5 : 49 : 49	0.1459	0.2432	LOGNORM	4.5348	0.3457	0.3457	81.0000	1.7685	0.3457
Butylbenzylphthalate	2 : 49 : 49	0.1808	0.2881	LOGNORM	0.2853	0.1591	0.1591	3.2000	0.1797	0.1591
Cadmium	46 : 49 : 49	0.6909	0.9285	LOGNORM	10.9517	26.0224	26.0224	54.0000	8.2488	26.0224
Calcium	49 : 49 : 49	0.8806	0.9696	LOGNORM	7531.3211	8359.4826	8359.4826	21000.0000	6491.2245	8359.4826
Carbazole	1 : 49 : 49	0.2421	0.4093	LOGNORM	0.1454	0.1334	0.1334	0.6200	0.1281	0.1334
Carbon disulfide	19 : 48 : 49	0.5379	0.7505	LOGNORM	0.0150	0.0129	0.0129	0.0770	0.0110	0.0129
Chlorobenzene	38 : 49 : 49	0.3338	0.8748	LOGNORM	0.8209	1.3890	1.3890	9.7000	0.4497	1.3890
Chloroform	1 : 5 : 49	0.8954	0.8870	NORMAL				0.0031	0.0027	0.0031
Chromium	49 : 49 : 49	0.8178	0.9706	LOGNORM	82.1829	90.2508	90.2508	180.0000	51.2735	90.2506
Chrysene	5 : 49 : 49	0.2684	0.5420	LOGNORM	0.2322	0.1702	0.1702	1.9000	0.1673	0.1702
Cobalt	49 : 49 : 49	0.9528	0.9173	NORMAL	9.5791	10.7017	9.5791	23.0000	8.5518	9.5791
Copper	49 : 49 : 49	0.3103	0.9639	LOGNORM	828.6229	1114.5326	1114.5326	10000.0000	484.1980	1114.5326
Cyanide	3 : 49 : 49	0.4333	0.5578	LOGNORM	0.4186	0.4007	0.4007	1.1000	0.3787	0.4007
Dalapon	1 : 5 : 49	0.8207	0.8206	NORMAL				0.0410	0.0395	0.0410
delta-BHC	2 : 44 : 49	0.3723	0.5603	LOGNORM	0.0007	0.0006	0.0006	0.0041	0.0005	0.0006
di-n-Butylphthalate	7 : 49 : 49	0.8265	0.7725	NORMAL	0.1199	0.1213	0.1199	0.2100	0.1146	0.1199
Dibenzo(a,h)anthracene	3 : 49 : 49	0.3590	0.4905	LOGNORM	0.0632	0.0763	0.0763	0.3400	0.0720	0.0763
Dibenzofuran	1 : 49 : 49	0.1760	0.3083	LOGNORM	0.1988	0.1470	0.1470	1.6000	0.1481	0.1470
Dicamba	12 : 12 : 49	0.8776	0.9222	LOGNORM	0.0035	0.0037	0.0037	0.0053	0.0028	0.0037
Dichlorprop	1 : 1 : 49			NA				0.0066	0.0066	0.0066
Dieldrin	8 : 47 : 49	0.4600	0.7033	LOGNORM	0.0111	0.0089	0.0089	0.0490	0.0077	0.0089
Endosulfan II	1 : 42 : 49	0.4205	0.5720	LOGNORM	0.0030	0.0028	0.0028	0.0100	0.0026	0.0028
Endosulfan sulfate	1 : 44 : 49	0.3922	0.5369	LOGNORM	0.0034	0.0031	0.0031	0.0120	0.0029	0.0031
Endrin ketone	3 : 3 : 49	0.8275	0.8627	LOGNORM				0.0015	0.0010	0.0015
Ethylbenzene	7 : 49 : 49	0.2293	0.4432	LOGNORM	0.2414	0.0304	0.0304	3.2000	0.1137	0.0304
Fluoranthene	9 : 49 : 49	0.2509	0.5052	LOGNORM	0.3767	0.2108	0.2108	4.0000	0.2348	0.2108
Fluorene	2 : 49 : 49	0.1577	0.2634	LOGNORM	0.3017	0.1609	0.1609	3.5000	0.1859	0.1609
gamma-BHC (Lindane)	10 : 40 : 49	0.8083	0.7253	NORMAL	0.0012	0.0013	0.0012	0.0023	0.0011	0.0012
gamma-Chlordane	2 : 2 : 49			NA				0.0004	0.0004	0.0004
Heptachlor	3 : 32 : 49	0.5650	0.4317	NORMAL	0.0012	0.0012	0.0012	0.0012	0.0011	0.0012
Heptachlor epoxide	14 : 49 : 49	0.2457	0.7847	LOGNORM	0.0266	0.0122	0.0122	0.4100	0.0143	0.0122
Indeno(1,2,3-cd)pyrene	4 : 49 : 49	0.2905	0.4727	LOGNORM	0.1641	0.1452	0.1452	0.8300	0.1386	0.1452
Iron	49 : 49 : 49	0.9646	0.6680	NORMAL	15035.2698	22971.1369	15035.2698	28000.0000	13755.9184	15035.2698
Lead	49 : 49 : 49	0.5261	0.9741	LOGNORM	101.8665	122.5835	122.5835	700.0000	74.6082	122.5835
Magnesium	49 : 49 : 49	0.9367	0.7556	NORMAL	4185.7749	7507.2800	4185.7749	6900.0000	3715.7959	4185.7749
Manganese	49 : 49 : 49	0.8306	0.8309	LOGNORM	152.4123	250.0797	250.0797	530.0000	130.1429	250.0797
MCPP	3 : 47 : 49	0.4004	0.5231	LOGNORM	1.8208	1.7110	1.7110	6.1000	1.6096	1.7110
Mercury	48 : 49 : 49	0.6348	0.9790	LOGNORM	0.1748	0.2386	0.2386	0.8400	0.1344	0.2386
Methoxychlor	6 : 6 : 49	0.6162	0.8359	LOGNORM				0.0066	0.0017	0.0066
Methylene chloride	4 : 6 : 49	0.9079	0.9127	LOGNORM				0.0029	0.0024	0.0029
Molybdenum	27 : 49 : 49	0.8039	0.9486	LOGNORM	0.9210	0.9581	0.9581	2.8000	0.7794	0.9581
N-Nitrosodiphenylamine	4 : 49 : 49	0.2203	0.5015	LOGNORM	0.1740	0.1410	0.1410	1.2000	0.1367	0.1410
Naphthalene	5 : 49 : 49	0.1924	0.3542	LOGNORM	0.4653	0.2020	0.2020	8.0000	0.2607	0.2020
Nickel	49 : 49 : 49	0.8911	0.8809	NORMAL	228.4362	403.1323	228.4362	630.0000	191.6204	228.4362

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	(t-test) Norm	H-test (Lognorm)	UCL (b)			
Nitrobenzene	2 : 49 : 49	0.2776	0.4567	LOGNORM	0.1406	0.1321	0.1321	0.5200	0.1266	0.1321
Pentachlorophenol	37 : 49 : 49	0.1617	0.8119	LOGNORM	2.4919	0.2647	0.2647	44.0000	0.9874	0.2647
Phenanthrene	6 : 49 : 49	0.2107	0.3942	LOGNORM	0.5477	0.2525	0.2525	7.0000	0.3009	0.2525
Phenol	3 : 49 : 49	0.1598	0.2761	LOGNORM	0.2975	0.1619	0.1619	3.4000	0.1851	0.1619
Potassium	49 : 49 : 49	0.9610	0.9587	NORMAL	1875.1006	1899.1692	1875.1006	3200.0000	1758.5714	1875.1006
Pyrene	5 : 49 : 49	0.2553	0.4216	LOGNORM	0.3834	0.2207	0.2207	4.0000	0.2424	0.2207
Selenium	2 : 49 : 49	0.4747	0.7864	LOGNORM	0.9820	0.8546	0.8546	4.5000	0.8092	0.8546
Silver	10 : 49 : 49	0.2369	0.6305	LOGNORM	1.0674	0.8002	0.8002	9.0000	0.7776	0.8002
Sodium	49 : 49 : 49	0.7415	0.9299	LOGNORM	223.8835	219.1236	219.1236	670.0000	199.1020	219.1236
Styrene	1 : 3 : 49	0.8928	0.9031	LOGNORM				0.0028	0.0025	0.0028
Tetrachloroethylene	3 : 48 : 49	0.2146	0.5109	LOGNORM	0.0076	0.0051	0.0051	0.0700	0.0053	0.0051
Thallium	3 : 49 : 49	0.8812	0.9500	LOGNORM	0.6705	0.6666	0.6666	1.3000	0.6289	0.6666
Tin	9 : 49 : 49	0.1798	0.4875	LOGNORM	30.3725	8.3006	8.3006	470.0000	14.3551	8.3006
Toluene	16 : 49 : 49	0.2825	0.6170	LOGNORM	0.0256	0.0138	0.0138	0.2900	0.0146	0.0138
Total PCBs	38 : 49 : 49	0.2357	0.7371	LOGNORM	5.8665	1.7354	1.7354	86.0600	2.7758	1.7354
Trichloroethene	3 : 48 : 49	0.2881	0.6081	LOGNORM	0.0056	0.0047	0.0047	0.0340	0.0045	0.0047
Vanadium	49 : 49 : 49	0.9548	0.7763	NORMAL	27.5113	30.1581	27.5113	47.0000	25.3449	27.5113
Xylenes (total)	13 : 49 : 49	0.1966	0.5138	LOGNORM	1.7794	0.1191	0.1191	29.0000	0.7639	0.1191
Zinc	49 : 49 : 49	0.8032	0.8687	LOGNORM	2855.0051	6183.4625	6183.4625	10450.0000	2160.5918	6163.4625
Creek Segment C										
2,3,7,8-TCDD-TEQ	9 : 9 : 9	0.7665	0.9241	LOGNORM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Butanone (MEK)	3 : 3 : 9	0.9735	0.9922	LOGNORM				0.0099	0.0076	0.0099
Acetone	5 : 9 : 9	0.8406	0.8923	LOGNORM	0.0477	0.0676	0.0676	0.0830	0.0342	0.0676
alpha-Chlordane	1 : 1 : 9			NA				0.0009	0.0009	0.0009
Aluminum	9 : 9 : 9	0.9161	0.9127	NORMAL	11785.0978	11965.9223	11785.0978	13000.0000	10811.1111	11785.0978
Antimony	1 : 1 : 9			NA				0.7900	0.7900	0.7900
Arsenic	9 : 9 : 9	0.9010	0.8403	NORMAL	12.1252	15.5579	12.1252	14.0000	9.7000	12.1252
Barium	9 : 9 : 9	0.8785	0.9305	LOGNORM	271.4979	271.8122	271.8122	330.0000	249.4444	271.8122
Benzene	1 : 1 : 9			NA				0.0030	0.0030	0.0030
Benzo(g,h,i)perylene	1 : 1 : 9			NA				0.0650	0.0650	0.0650
Beryllium	9 : 9 : 9	0.9306	0.9429	LOGNORM	0.8854	0.8944	0.8944	0.9600	0.8278	0.8944
Cadmium	9 : 9 : 9	0.9556	0.7435	NORMAL	17.4163	34.1626	17.4163	24.0000	13.2833	17.4163
Calcium	9 : 9 : 9	0.9290	0.9763	LOGNORM	9766.3828	10173.0609	10173.0609	14000.0000	7805.5556	10173.0609
Chlorobenzene	9 : 9 : 9	0.8267	0.9791	LOGNORM	0.2690	6.9945	6.9945	0.7000	0.1302	0.7000
Chromium	9 : 9 : 9	0.6389	0.8447	LOGNORM	53.8760	58.2686	58.2686	110.0000	36.1111	58.2686
Cobalt	9 : 9 : 9	0.9370	0.9129	NORMAL	10.9639	11.6229	10.9639	14.0000	9.4111	10.9639
Copper	9 : 9 : 9	0.8940	0.9553	LOGNORM	149.3844	212.7920	212.7920	250.0000	109.1111	212.7920
delta-BHC	3 : 6 : 9	0.9030	0.9251	LOGNORM				0.0010	0.0007	0.0010
Dicamba	1 : 1 : 9			NA				0.0066	0.0066	0.0066
Dichlorprop	1 : 1 : 9			NA				0.0062	0.0062	0.0062
Dieldrin	8 : 9 : 9	0.8451	0.8963	LOGNORM	0.0074	0.0255	0.0255	0.0110	0.0048	0.0110
Endosulfan sulfate	3 : 7 : 9	0.8964	0.7827	NORMAL				0.0070	0.0042	0.0070
Endrin ketone	1 : 6 : 9	0.5763	0.6150	LOGNORM				0.0100	0.0057	0.0100
gamma-Chlordane	1 : 1 : 9			NA				0.0011	0.0011	0.0011

Table A-1
 Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	(t-test) Norm	H-test (Lognorm)	UCL (b)			
Iron	9:9:9	0.9288	0.8899	NORMAL	19337.7793	19788.6998	19337.7793	21000.0000	17611.1111	18337.7793
Lead	9:9:9	0.6556	0.8988	LOGNORM	66.9625	79.2414	79.2414	140.0000	43.2222	79.2414
Magnesium	9:9:9	0.9637	0.9632	LOGNORM	5172.8332	5177.6052	5177.6052	6700.0000	4427.7778	5177.6052
Manganese	9:9:9	0.8917	0.9662	LOGNORM	245.8121	261.3737	261.3737	390.0000	188.7778	261.3737
Mercury	9:9:9	0.6108	0.8553	LOGNORM	0.1462	0.1648	0.1648	0.3100	0.0956	0.1648
Methoxychlor	3:3:9	0.8087	0.8050	NORMAL				0.0071	0.0042	0.0071
Methylene chloride	4:9:9	0.9185	0.8202	NORMAL	0.0040	0.0042	0.0040	0.0048	0.0035	0.0040
Nickel	9:9:9	0.9557	0.9270	NORMAL	357.1853	498.2301	357.1853	570.0000	263.0556	357.1853
Pentachlorophenol	7:9:9	0.7764	0.8663	LOGNORM	0.0092	0.0160	0.0160	0.0140	0.0061	0.0140
Phenanthrene	1:1:9			NA				0.0250	0.0250	0.0250
Potassium	9:9:9	0.9741	0.8508	NORMAL	2027.3301	2049.2609	2027.3301	2300.0000	1872.2222	2027.3301
Sodium	9:9:9	0.8049	0.8647	LOGNORM	144.4834	143.1933	143.1933	200.0000	123.8889	143.1933
Styrene	1:1:9			NA				0.0027	0.0027	0.0027
Tin	1:9:9	0.5746	0.6565	LOGNORM	4.7638	4.7399	4.7399	7.5000	3.9308	4.7399
Toluene	4:9:9	0.6022	0.6297	LOGNORM	0.0049	0.0048	0.0048	0.0075	0.0041	0.0048
Total PCBs	6:9:9	0.6513	0.8096	LOGNORM	0.0953	0.0974	0.0974	0.1782	0.0691	0.0974
Vanadium	9:9:9	0.9703	0.9538	NORMAL	33.7495	34.3059	33.7495	37.0000	31.0000	33.7495
Xylenes (total)	1:8:9	0.9259	0.9371	LOGNORM	0.0039	0.0039	0.0039	0.0043	0.0037	0.0039
Zinc	9:9:9	0.9364	0.7600	NORMAL	2776.0162	4654.0375	2776.0162	3400.0000	2136.6667	2776.0162
Creek Segment D										
1,4-Dichlorobenzene	2:6:6	0.6712	0.6182	NORMAL				0.1300	0.1122	0.1300
2,3,7,8-TCDD-TEQ	6:6:6	0.5190	0.6662	LOGNORM				0.0009	0.0002	0.0009
2,4,5-T	1:1:6			NA				0.0054	0.0054	0.0054
2-Butanone (MEK)	3:3:6	0.9939	0.9998	LOGNORM				0.0100	0.0081	0.0100
4,4'-DDD	1:1:6			NA				0.0014	0.0014	0.0014
4,4'-DDT	1:6:6	0.6320	0.8770	LOGNORM				0.2400	0.0662	0.2400
Aldrin	2:5:6	0.9244	0.8604	NORMAL				0.0090	0.0060	0.0090
alpha-Chlordane	1:5:6	0.8723	0.8543	NORMAL				0.0120	0.0068	0.0120
Aluminum	6:6:6	0.9444	0.9507	LOGNORM				14000.0000	10900.0000	14000.0000
Arsenic	6:6:6	0.9689	0.9782	LOGNORM				18.0000	11.4000	18.0000
Barium	6:6:6	0.7853	0.8898	LOGNORM				570.0000	311.6667	570.0000
Benzo(a)pyrene	3:6:6	0.7862	0.8338	LOGNORM				0.1400	0.0848	0.1400
Benzo(b)fluoranthene	1:6:6	0.6513	0.6937	LOGNORM				0.2000	0.1358	0.2000
Benzo(g,h,i)perylene	2:6:6	0.6380	0.6857	LOGNORM				0.2200	0.1400	0.2200
Benzo(k)fluoranthene	1:6:6	0.6343	0.6771	LOGNORM				0.2100	0.1375	0.2100
Beryllium	6:6:6	0.8298	0.8078	NORMAL				0.9900	0.8383	0.9900
Cadmium	6:6:6	0.8541	0.9344	LOGNORM				40.0000	19.7500	40.0000
Calcium	6:6:6	0.5739	0.6869	LOGNORM				25000.0000	8533.3333	25000.0000
Chlorobenzene	5:6:6	0.5882	0.8805	LOGNORM				0.1500	0.0313	0.1500
Chromium	6:6:6	0.9173	0.9174	LOGNORM				57.0000	49.3333	57.0000
Cobalt	6:6:6	0.9254	0.9031	NORMAL				12.0000	9.4667	12.0000
Copper	6:6:6	0.5870	0.8240	LOGNORM				1600.0000	385.5000	1600.0000
Dalapon	1:6:6	0.9670	0.9633	NORMAL				0.0500	0.0475	0.0500
delta-BHC	4:5:6	0.6981	0.8168	LOGNORM				0.0019	0.0008	0.0019

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	t-test Norm	H-test (Lognorm)	UCL (b)			
Dicamba	1 : 1 : 6			NA				0.0018	0.0018	0.0018
Dichlorprop	1 : 1 : 6			NA				0.0210	0.0210	0.0210
Diekdrin	5 : 6 : 6	0.5511	0.8829	LOGNORM				0.6900	0.1274	0.6900
Endosulfan sulfate	1 : 2 : 6			NA				0.0095	0.0071	0.0095
Fluoranthene	4 : 6 : 6	0.9306	0.9150	NORMAL				0.1900	0.1307	0.1900
gamma-Chlordane	2 : 6 : 6	0.5579	0.7917	LOGNORM				0.0670	0.0155	0.0670
Indeno(1,2,3-cd)pyrene	2 : 6 : 6	0.7589	0.8084	LOGNORM				0.1800	0.1300	0.1800
Iron	6 : 6 : 6	0.9752	0.9634	NORMAL				20000.0000	17166.6667	20000.0000
Lead	6 : 6 : 6	0.7912	0.9261	LOGNORM				280.0000	98.1667	280.0000
Magnesium	6 : 6 : 6	0.9525	0.9813	LOGNORM				5000.0000	3786.6667	5000.0000
Manganese	6 : 6 : 6	0.8979	0.9022	LOGNORM				190.0000	136.6667	190.0000
Mercury	6 : 6 : 6	0.7625	0.9040	LOGNORM				0.7100	0.2375	0.7100
Methoxychlor	3 : 4 : 6	0.8675	0.9868	LOGNORM				0.0620	0.0247	0.0620
Methylene chloride	4 : 4 : 6	0.8512	0.8430	NORMAL				0.0032	0.0027	0.0032
Molybdenum	2 : 6 : 6	0.7286	0.7641	LOGNORM				7.0000	2.3300	7.0000
Nickel	6 : 6 : 6	0.9592	0.9632	LOGNORM				530.0000	286.6667	530.0000
Pentachlorophenol	5 : 6 : 6	0.8578	0.8703	LOGNORM				0.0130	0.0069	0.0130
Phenanthrene	2 : 4 : 6	0.6787	0.6624	NORMAL				0.1200	0.1005	0.1200
Potassium	6 : 6 : 6	0.7618	0.7740	LOGNORM				2100.0000	1800.0000	2100.0000
Pyrene	3 : 6 : 6	0.8241	0.8359	LOGNORM				0.1600	0.1317	0.1600
Selenium	1 : 5 : 6	0.8498	0.9552	LOGNORM				2.8000	1.2700	2.8000
Silver	1 : 6 : 6	0.6290	0.8950	LOGNORM				1.5000	0.8250	1.5000
Sodium	6 : 6 : 6	0.7482	0.8383	LOGNORM				330.0000	175.0000	330.0000
Tin	2 : 6 : 6	0.7479	0.8115	LOGNORM				11.0000	5.2333	11.0000
Toluene	1 : 1 : 6			NA				0.0029	0.0029	0.0029
Total PCBs	5 : 6 : 6	0.5613	0.7473	LOGNORM				2.4396	0.4915	2.4396
Vanadium	6 : 6 : 6	0.9409	0.9276	NORMAL				36.0000	31.5000	36.0000
Zinc	6 : 6 : 6	0.8470	0.9040	LOGNORM				8200.0000	4100.0000	8200.0000
Creek Segment E										
1,4-Dichlorobenzene	1 : 17 : 17	0.5525	0.6452	LOGNORM	0.1417	0.1399	0.1399	0.2300	0.1301	0.1399
2,3,7,8-TCDD-TEQ	14 : 17 : 17	0.6948	0.9345	LOGNORM	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
2,4-D	2 : 17 : 17	0.4089	0.4912	LOGNORM	0.0114	0.0101	0.0101	0.0350	0.0063	0.0101
2-Butanone (MEK)	5 : 5 : 17	0.9853	0.9749	NORMAL				0.0140	0.0106	0.0140
4,4'-DDD	2 : 17 : 17	0.4477	0.7089	LOGNORM	0.0109	0.0098	0.0098	0.0470	0.0062	0.0098
4,4'-DDE	6 : 15 : 17	0.7456	0.8356	LOGNORM	0.0028	0.0049	0.0049	0.0072	0.0021	0.0049
4,4'-DDT	7 : 17 : 17	0.6663	0.8737	LOGNORM	0.0068	0.0090	0.0090	0.0170	0.0045	0.0090
Acetone	9 : 17 : 17	0.8855	0.9134	LOGNORM	0.0436	0.0453	0.0453	0.0730	0.0378	0.0453
alpha-BHC	1 : 15 : 17	0.3851	0.4508	LOGNORM	0.0005	0.0005	0.0005	0.0013	0.0004	0.0005
alpha-Chlordane	1 : 17 : 17	0.5068	0.5563	LOGNORM	0.0034	0.0032	0.0032	0.0087	0.0023	0.0032
Aluminum	17 : 17 : 17	0.9460	0.9224	NORMAL	10905.1667	11126.8712	10905.1667	14000.0000	9967.6471	10905.1667
Anthracene	1 : 1 : 17			NA				0.0500	0.0500	0.0500
Antimony	3 : 17 : 17	0.5354	0.7925	LOGNORM	1.8068	1.7490	1.7490	4.7000	1.4341	1.7490
Arsenic	16 : 17 : 17	0.8650	0.8952	LOGNORM	9.8559	10.9968	10.9968	20.0000	8.0824	10.9968
Barium	17 : 17 : 17	0.5684	0.7932	LOGNORM	296.5397	287.6398	287.6398	640.0000	252.0588	287.6398

Table A-1
 Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	(t-test) Norm	H-test (Lognorm)	UCL (b)			
Benzo(a)anthracene	3 : 17 : 17	0.6000	0.6902	LOGNORM	0.1419	0.1423	0.1423	0.2600	0.1256	0.1423
Benzo(a)pyrene	3 : 17 : 17	0.3727	0.4807	LOGNORM	0.1265	0.1081	0.1081	0.4200	0.0897	0.1081
Benzo(b)fluoranthene	4 : 17 : 17	0.4804	0.7018	LOGNORM	0.1823	0.1788	0.1788	0.5100	0.1407	0.1788
Benzo(g,h,i)perylene	3 : 17 : 17	0.5294	0.6970	LOGNORM	0.1598	0.1550	0.1550	0.3500	0.1351	0.1550
Benzo(k)fluoranthene	3 : 17 : 17	0.4385	0.5945	LOGNORM	0.1614	0.1535	0.1535	0.3700	0.1353	0.1535
Beryllium	17 : 17 : 17	0.9222	0.8486	NORMAL	0.8278	0.8716	0.8278	1.1000	0.7444	0.8278
Bis(2-ethylhexyl)phthalate	1 : 1 : 17			NA				0.0770	0.0770	0.0770
Cadmium	17 : 17 : 17	0.8900	0.9321	LOGNORM	18.4017	23.0738	23.0738	38.0000	14.2147	23.0738
Calcium	17 : 17 : 17	0.9092	0.9300	LOGNORM	9399.7150	10046.1901	10046.1901	13000.0000	8017.6471	10046.1901
Chlorobenzene	12 : 17 : 17	0.4565	0.8807	LOGNORM	0.0447	0.0497	0.0497	0.2100	0.0233	0.0497
Chromium	17 : 17 : 17	0.7285	0.8503	LOGNORM	66.3501	72.7193	72.7193	170.0000	47.2941	72.7193
Chrysene	4 : 17 : 17	0.5818	0.7316	LOGNORM	0.1585	0.1623	0.1623	0.3700	0.1315	0.1823
Cobalt	17 : 17 : 17	0.9755	0.9311	NORMAL	9.0941	9.5415	9.0941	13.0000	8.0794	9.0941
Copper	17 : 17 : 17	0.3973	0.9251	LOGNORM	852.2610	1088.1405	1088.1405	4300.0000	425.2059	1088.1405
Cyanide	1 : 17 : 17	0.3317	0.4786	LOGNORM	0.7319	0.5961	0.5961	2.6000	0.5031	0.5961
di-n-Butylphthalate	1 : 1 : 17			NA				0.0740	0.0740	0.0740
Dibenzo(a,h)anthracene	1 : 17 : 17	0.4855	0.5535	LOGNORM	0.0773	0.0757	0.0757	0.1400	0.0693	0.0757
Dicamba	1 : 1 : 17			NA				0.0025	0.0025	0.0025
Dieldrin	13 : 17 : 17	0.5752	0.9432	LOGNORM	0.0096	0.0226	0.0226	0.0340	0.0055	0.0226
Endosulfan I	3 : 3 : 17	0.9643	0.9432	NORMAL				0.0002	0.0001	0.0002
Endosulfan II	1 : 1 : 17			NA				0.0007	0.0007	0.0007
Endosulfan sulfate	2 : 17 : 17	0.4542	0.5765	LOGNORM	0.0051	0.0045	0.0045	0.0160	0.0036	0.0045
Ethylbenzene	1 : 17 : 17	0.8954	0.9282	LOGNORM	0.0039	0.0039	0.0039	0.0049	0.0036	0.0039
Fluoranthene	4 : 17 : 17	0.4455	0.6404	LOGNORM	0.2257	0.2027	0.2027	0.7100	0.1630	0.2027
gamma-Chlordane	2 : 18 : 17	0.5374	0.6875	LOGNORM	0.0023	0.0025	0.0025	0.0055	0.0017	0.0025
Heptachlor epoxide	6 : 5 : 17	0.8633	0.6342	NORMAL				0.0008	0.0004	0.0008
Indeno(1,2,3-cd)pyrene	2 : 17 : 17	0.4171	0.5228	LOGNORM	0.1613	0.1542	0.1542	0.3500	0.1378	0.1542
Iron	17 : 17 : 17	0.9622	0.8900	NORMAL	19879.6367	20953.8237	19879.6367	27000.0000	17778.4706	19879.6367
Lead	17 : 17 : 17	0.6348	0.9324	LOGNORM	118.0379	126.8276	126.8276	400.0000	78.5000	126.8276
Magnesium	17 : 17 : 17	0.9662	0.9088	NORMAL	5176.0084	5633.1471	5176.0084	6900.0000	4505.8824	5176.0084
Manganese	17 : 17 : 17	0.9783	0.9528	NORMAL	199.8314	215.7635	199.8314	300.0000	173.0000	199.8314
Mercury	17 : 17 : 17	0.7759	0.8560	LOGNORM	0.5681	0.6996	0.6996	1.6000	0.4059	0.6996
Methoxychlor	3 : 3 : 17	0.9368	0.9060	NORMAL				0.0009	0.0007	0.0009
Methylene chloride	3 : 6 : 17	0.8234	0.8086	NORMAL				0.0033	0.0028	0.0033
Molybdenum	2 : 17 : 17	0.7245	0.9364	LOGNORM	0.5269	0.5521	0.5521	1.5000	0.3840	0.5521
Nickel	17 : 17 : 17	0.7970	0.8541	LOGNORM	236.4887	267.0735	267.0735	600.0000	181.2647	267.0735
Pentachlorophenol	7 : 17 : 17	0.7814	0.7827	LOGNORM	0.0143	0.0207	0.0207	0.0330	0.0113	0.0207
Phenanthrene	4 : 17 : 17	0.6216	0.6576	LOGNORM	0.1458	0.1649	0.1649	0.2900	0.1256	0.1649
Potassium	17 : 17 : 17	0.9684	0.9440	NORMAL	2260.3557	2296.4279	2260.3557	2900.0000	2070.5882	2260.3557
Pyrene	3 : 17 : 17	0.4353	0.5847	LOGNORM	0.1852	0.1718	0.1718	0.4800	0.1475	0.1718
Silver	3 : 17 : 17	0.2777	0.3506	LOGNORM	2.1380	1.3805	1.3805	9.6000	1.2029	1.3805
Sodium	17 : 17 : 17	0.9405	0.9719	LOGNORM	265.9138	267.4951	267.4951	390.0000	241.1765	267.4951
Thallium	1 : 18 : 17	0.9625	0.9737	LOGNORM	0.7130	0.7228	0.7228	0.8800	0.6808	0.7228
Tin	3 : 17 : 17	0.4156	0.5801	LOGNORM	8.4907	7.0619	7.0619	31.0000	5.6044	7.0619
Toluene	3 : 17 : 17	0.9379	0.9532	LOGNORM	0.0040	0.0039	0.0039	0.0045	0.0037	0.0039

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Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	t-test Norm	H-test (Lognorm)	UCL (b)			
Total PCBs	10 : 17 : 17	0.4429	0.5997	LOGNORM	0.3320	0.2704	0.2704	1.2517	0.1869	0.2704
Vanadium	17 : 17 : 17	0.9245	0.8742	NORMAL	31.9722	32.6298	31.9722	39.0000	29.4706	31.9722
Zinc	17 : 17 : 17	0.8635	0.9546	LOGNORM	2491.6020	3115.2931	3115.2931	5900.0000	1923.8235	3115.2931
Creek Segment F										
1,1,2,2-Tetrachloroethane	1 : 16 : 16	0.4877	0.6282	LOGNORM	0.0046	0.0044	0.0044	0.0100	0.0039	0.0044
1,1,2-Trichloroethane	1 : 16 : 16	0.7098	0.7949	LOGNORM	0.0040	0.0040	0.0040	0.0061	0.0037	0.0040
1,2-Dichloroethane	1 : 1 : 16			NA				0.0021	0.0021	0.0021
1,4-Dichlorobenzene	1 : 1 : 16			NA				0.0940	0.0940	0.0940
2,3,7,8-TCDD-TEQ	16 : 16 : 16	0.4179	0.8169	LOGNORM	0.0002	0.0001	0.0001	0.0008	0.0001	0.0001
2,4-D	3 : 16 : 16	0.4309	0.5277	LOGNORM	0.0093	0.0063	0.0063	0.0263	0.0070	0.0063
2-Butanone (MEK)	7 : 8 : 16	0.8737	0.9383	LOGNORM	0.0118	0.0125	0.0125	0.0140	0.0103	0.0125
4,4'-DDE	4 : 4 : 15	0.9969	0.9325	NORMAL				0.0016	0.0010	0.0016
4,4'-DDT	3 : 15 : 15	0.9052	0.7652	NORMAL	0.0042	0.0061	0.0042	0.0075	0.0034	0.0042
Acetone	7 : 16 : 16	0.7930	0.8363	LOGNORM	0.0481	0.0498	0.0498	0.0640	0.0422	0.0498
Aldrin	1 : 1 : 16			NA				0.0002	0.0002	0.0002
alpha-Chlordane	2 : 15 : 16	0.8374	0.8636	LOGNORM	0.0024	0.0025	0.0025	0.0041	0.0020	0.0025
Aluminum	16 : 16 : 16	0.9466	0.8995	NORMAL	9834.8440	9899.0391	9834.8440	12000.0000	8862.5000	9834.8440
Antimony	2 : 3 : 16	0.9643	0.9686	LOGNORM				0.8600	0.8267	0.8600
Arsenic	15 : 16 : 16	0.9523	0.9171	NORMAL	11.3737	12.5865	11.3737	19.0000	9.7125	11.3737
Barium	16 : 16 : 16	0.9011	0.8795	NORMAL	242.2900	241.3570	242.2900	330.0000	218.7500	242.2900
Benzo(a)anthracene	4 : 4 : 16	0.8175	0.8092	NORMAL				0.0920	0.0623	0.0920
Benzo(a)pyrene	5 : 16 : 16	0.4714	0.5995	LOGNORM	0.0639	0.0798	0.0798	0.1900	0.0695	0.0798
Benzo(b)fluoranthene	5 : 16 : 16	0.8507	0.8929	NORMAL	0.1308	0.1470	0.1308	0.1800	0.1143	0.1308
Benzo(g,h,i)perylene	5 : 15 : 16	0.7780	0.8205	NORMAL	0.1174	0.1257	0.1174	0.1300	0.1073	0.1174
Benzo(k)fluoranthene	4 : 15 : 16	0.6289	0.5499	NORMAL	0.1213	0.1314	0.1213	0.1300	0.1101	0.1213
Beryllium	13 : 16 : 16	0.9130	0.9342	LOGNORM	0.7008	0.7924	0.7924	0.8900	0.6098	0.7924
beta-BHC	1 : 16 : 16	0.5776	0.8069	LOGNORM	0.0012	0.0011	0.0011	0.0039	0.0008	0.0011
Bis(2-ethylhexyl)phthalate	4 : 8 : 16	0.7384	0.7624	LOGNORM				0.1100	0.0908	0.1100
Bromodichloromethane	1 : 1 : 16			NA				0.0013	0.0013	0.0013
Bromoform	1 : 2 : 16			NA				0.0030	0.0030	0.0030
Cadmium	15 : 16 : 16	0.9191	0.8979	NORMAL	27.9783	104.2906	27.9783	57.0000	20.3078	27.9783
Calcium	16 : 16 : 16	0.8696	0.9304	LOGNORM	11563.1904	12102.6984	12102.6984	17000.0000	9803.1250	12102.6984
Chlorobenzene	3 : 16 : 16	0.5444	0.6741	LOGNORM	0.0057	0.0054	0.0054	0.0140	0.0044	0.0054
Chromium	16 : 16 : 16	0.9234	0.9577	LOGNORM	19.3593	18.5488	18.5488	29.0000	16.8094	18.5488
Chrysene	5 : 16 : 16	0.7459	0.5780	NORMAL	0.1212	0.1371	0.1212	0.1400	0.1084	0.1212
Cobalt	16 : 16 : 16	0.9344	0.9704	LOGNORM	9.8202	9.6350	9.6350	13.0000	8.8375	9.6350
Copper	16 : 18 : 16	0.7296	0.9332	LOGNORM	171.2765	239.0506	239.0506	505.0000	119.6875	239.0506
Cyanide	2 : 16 : 16	0.3549	0.4358	LOGNORM	1.1212	1.0926	1.0926	4.5700	0.6559	1.0926
Dibromochloromethane	1 : 1 : 16			NA				0.0020	0.0020	0.0020
Dicamba	4 : 4 : 16	0.7675	0.7452	NORMAL				0.0063	0.0041	0.0063
Dieldrin	9 : 16 : 16	0.7549	0.9450	LOGNORM	0.0031	0.0037	0.0037	0.0082	0.0023	0.0037
Endosulfan sulfate	1 : 10 : 16	0.6408	0.6974	LOGNORM	0.0032	0.0032	0.0032	0.0043	0.0027	0.0032
Fluoranthene	5 : 16 : 16	0.8409	0.6958	NORMAL	0.1242	0.1330	0.1242	0.1700	0.1118	0.1242
gamma-Chlordane	6 : 16 : 16	0.8786	0.9629	LOGNORM	0.0019	0.0020	0.0020	0.0038	0.0015	0.0020

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	t-test (Norm)	H-test (Lognorm)	UCL (b)			
Hexachlorobutadiene	1 : 1 : 16			NA				0.0610	0.0610	0.0610
Indeno(1,2,3-cd)pyrene	2 : 5 : 16	0.5521	0.5521	LOGNORM				0.1100	0.1064	0.1100
Iron	16 : 16 : 16	0.8226	0.9645	LOGNORM	22424.8738	22547.9875	22547.9875	41000.0000	19340.6250	22547.9875
Lead	16 : 16 : 16	0.4215	0.8432	LOGNORM	104.6570	85.0979	85.0979	450.0000	58.1250	85.0979
Magnesium	16 : 16 : 16	0.9252	0.9773	LOGNORM	5813.0862	5882.4318	5882.4318	8200.0000	5271.8750	5882.4318
Manganese	16 : 16 : 16	0.7966	0.9819	LOGNORM	415.7382	444.3555	444.3555	890.0000	334.8438	444.3555
MCPP	1 : 16 : 16	0.5626	0.6395	LOGNORM	1.5672	1.5455	1.5455	2.3000	1.4625	1.5455
Mercury	16 : 16 : 16	0.7071	0.9625	LOGNORM	0.2908	0.4109	0.4109	0.8200	0.1911	0.4109
Methylene chloride	4 : 15 : 16	0.9132	0.7965	NORMAL	0.0035	0.0036	0.0035	0.0043	0.0033	0.0035
Molybdenum	2 : 16 : 16	0.5663	0.8880	LOGNORM	0.7872	0.7635	0.7635	2.2000	0.5903	0.7635
Nickel	16 : 16 : 16	0.8027	0.9730	LOGNORM	233.0025	329.7951	329.7951	630.0000	167.3750	329.7951
Pentachlorophenol	8 : 16 : 16	0.8881	0.8473	NORMAL	0.0117	0.0176	0.0117	0.0240	0.0091	0.0117
Phenanthrene	4 : 4 : 16	0.9177	0.9258	LOGNORM				0.0980	0.0593	0.0980
Potassium	16 : 16 : 16	0.9139	0.9419	LOGNORM	1798.5178	1806.8092	1806.8092	2300.0000	1592.6125	1806.8092
Pyrene	2 : 16 : 16	0.7085	0.7654	LOGNORM	0.1267	0.1257	0.1257	0.1600	0.1213	0.1257
Selenium	1 : 15 : 16	0.6898	0.8919	LOGNORM	0.8429	0.8054	0.8054	1.8000	0.6892	0.8054
Silver	1 : 16 : 16	0.8990	0.8388	NORMAL	0.8901	0.6822	0.6901	0.7900	0.6650	0.6901
Sodium	15 : 16 : 16	0.7481	0.8789	LOGNORM	159.9971	157.5393	157.5393	290.0000	137.8438	157.5393
Tin	1 : 16 : 16	0.4680	0.7692	LOGNORM	5.3551	5.0492	5.0492	17.0000	3.7734	5.0492
Toluene	8 : 16 : 16	0.8687	0.9225	LOGNORM	0.0051	0.0045	0.0045	0.0077	0.0043	0.0045
Total PCBs	7 : 16 : 16	0.3299	0.4628	LOGNORM	0.1012	0.0815	0.0815	0.3569	0.0675	0.0815
Vanadium	16 : 16 : 16	0.9424	0.8928	NORMAL	27.7868	28.3292	27.7868	34.0000	25.6563	27.7868
Xylenes (total)	1 : 15 : 16	0.9845	0.9573	NORMAL	0.0038	0.0035	0.0038	0.0041	0.0034	0.0036
Zinc	16 : 16 : 16	0.4688	0.8681	LOGNORM	3757.9441	5373.8152	5373.8152	15000.0000	2238.3750	5373.8152
Site M										
1,2,4-Trichlorobenzene	2 : 5 : 9	0.8976	0.7705	NORMAL				0.1600	0.1038	0.1600
1,2-Dichlorobenzene	1 : 5 : 9	0.6303	0.8600	LOGNORM				0.2100	0.1290	0.2100
1,4-Dichlorobenzene	3 : 9 : 9	0.7282	0.8456	LOGNORM	1.7747	8.2984	8.2984	4.1000	0.9783	4.1000
2,3,7,8-TCDD-TEQ	9 : 9 : 9	0.5432	0.9310	LOGNORM	0.0019	0.0051	0.0051	0.0052	0.0010	0.0051
2,4,5-T	1 : 1 : 9			NA				0.0018	0.0018	0.0018
2,4-DB	2 : 9 : 9	0.7070	0.6808	NORMAL	0.0285	0.0459	0.0285	0.0520	0.0172	0.0285
2-Butanone (MEK)	9 : 9 : 9	0.8687	0.8625	NORMAL	0.0727	0.1619	0.0727	0.1000	0.0501	0.0727
4,4'-DDE	1 : 7 : 9	0.9013	0.8687	NORMAL				0.0350	0.0167	0.0350
4,4'-DDT	5 : 9 : 9	0.5463	0.8497	LOGNORM	0.4728	1.6099	1.6099	1.3000	0.2171	1.3000
4-Chloroaniline	1 : 1 : 9			NA				0.1000	0.1000	0.1000
Acenaphthene	2 : 2 : 9			NA				0.0880	0.0625	0.0880
Acetone	8 : 9 : 9	0.8749	0.8788	LOGNORM	0.3306	2.0368	2.0368	0.5650	0.2074	0.5650
alpha-BHC	1 : 5 : 9	0.8524	0.8433	NORMAL				0.0023	0.0015	0.0023
Aluminum	9 : 9 : 9	0.8975	0.9507	LOGNORM	4908.1230	5367.4596	5367.4596	7500.0000	3872.2222	5367.4596
Anthracene	2 : 6 : 9	0.6968	0.7926	LOGNORM				0.2300	0.1243	0.2300
Antimony	5 : 9 : 9	0.8021	0.8593	LOGNORM	4.4865	5.2734	5.2734	6.8000	2.9100	5.2734
Arsenic	9 : 9 : 9	0.6484	0.8909	LOGNORM	11.5428	11.4699	11.4699	25.0000	7.2778	11.4699
Barium	9 : 9 : 9	0.6849	0.9545	LOGNORM	779.0289	1171.0904	1171.0904	1800.0000	450.8889	1171.0904
Benzene	4 : 9 : 9	0.5565	0.7610	LOGNORM	0.0151	0.0177	0.0177	0.0370	0.0084	0.0177

Table A-1
Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	t-test Norm	H-test (Lognorm)	UCL (b)			
Benzo(a)anthracene	8 : 9 : 9	0.7928	0.9509	LOGNORM	0.4169	1.3652	1.3652	0.7200	0.2542	0.7200
Benzo(a)pyrene	5 : 8 : 9	0.7461	0.7863	LOGNORM	0.3435	0.8813	0.8813	0.4800	0.2141	0.4800
Benzo(b)fluoranthene	5 : 7 : 9	0.6765	0.7437	LOGNORM				0.6100	0.2371	0.6100
Benzo(g,h,i)perylene	5 : 6 : 9	0.8844	0.9821	LOGNORM				0.4100	0.1685	0.4100
Benzo(k)fluoranthene	4 : 6 : 9	0.7147	0.9000	LOGNORM				0.3400	0.1292	0.3400
Beryllium	9 : 9 : 9	0.9101	0.9833	LOGNORM	0.3683	0.4042	0.4042	0.5500	0.2939	0.4042
Bis(2-ethylhexyl)phthalate	4 : 9 : 9	0.7829	0.8030	LOGNORM	0.7534	1.9248	1.9248	1.1300	0.4779	1.1300
Cadmium	9 : 9 : 9	0.7844	0.9716	LOGNORM	8.1455	13.3960	13.3960	17.0000	4.9200	13.3960
Calcium	9 : 9 : 9	0.8783	0.9128	LOGNORM	10069.6667	12059.3529	12059.3529	16000.0000	7544.4444	12059.3529
Carbazole	1 : 1 : 9			NA				0.0320	0.0320	0.0320
Carbon disulfide	8 : 9 : 9	0.6874	0.9043	LOGNORM	0.0409	0.0916	0.0916	0.0795	0.0234	0.0795
Chlorobenzene	8 : 9 : 9	0.8047	0.8440	LOGNORM	0.8066	695.6861	695.6861	1.2000	0.3384	1.2000
Chromium	9 : 9 : 9	0.7260	0.9646	LOGNORM	27.4812	25.9186	25.9186	55.0000	18.5111	25.9186
Chrysene	8 : 9 : 9	0.7924	0.9461	LOGNORM	0.4829	1.2413	1.2413	0.8150	0.2988	0.8150
Cobalt	9 : 9 : 9	0.7350	0.8758	LOGNORM	12.3696	12.4338	12.4338	23.5000	8.2444	12.4338
Copper	9 : 9 : 9	0.6959	0.9473	LOGNORM	2509.3504	6184.9743	6184.9743	4900.0000	1437.7778	4900.0000
Cyanide	2 : 9 : 9	0.7708	0.7155	NORMAL	0.7739	0.7589	0.7739	0.9900	0.6961	0.7739
Dibenzo(a,h)anthracene	2 : 5 : 9	0.7197	0.7866	LOGNORM				0.1500	0.0806	0.1500
Dibenzofuran	1 : 1 : 9			NA				0.0770	0.0770	0.0770
Dicamba	2 : 2 : 9			NA				0.0033	0.0030	0.0033
Dichlorprop	1 : 1 : 9			NA				0.0240	0.0240	0.0240
Endrin aldehyde	6 : 9 : 9	0.4476	0.8096	LOGNORM	0.2797	0.6513	0.6513	0.8300	0.1158	0.6513
Ethylbenzene	4 : 9 : 9	0.7438	0.8388	LOGNORM	0.0066	0.0070	0.0070	0.0110	0.0049	0.0070
Fluoranthene	8 : 9 : 9	0.7628	0.8979	LOGNORM	0.8696	3.3901	3.3901	1.7000	0.5076	1.7000
Fluorene	3 : 6 : 9	0.7424	0.9331	LOGNORM				0.4900	0.1733	0.4900
gamma-BHC (Lindane)	4 : 4 : 9	0.9532	0.8618	NORMAL				0.0044	0.0028	0.0044
Heptachlor	2 : 9 : 9	0.4857	0.8654	LOGNORM	0.0574	0.1021	0.1021	0.1600	0.0266	0.1021
Heptachlor epoxide	3 : 9 : 9	0.4212	0.8259	LOGNORM	0.2804	1.2218	1.2218	0.8800	0.1080	0.8600
Indeno(1,2,3-cd)pyrene	2 : 5 : 9	0.8488	0.9064	LOGNORM				0.1700	0.1174	0.1700
Iron	9 : 9 : 9	0.8284	0.8621	LOGNORM	13280.8594	14200.7200	14200.7200	18000.0000	10477.7778	14200.7200
Lead	9 : 9 : 9	0.8041	0.9389	LOGNORM	147.7081	271.7360	271.7360	270.0000	92.3333	270.0000
Magnesium	9 : 9 : 9	0.8841	0.9513	LOGNORM	4170.9554	4493.6120	4493.6120	6500.0000	3277.7778	4493.6120
Manganese	9 : 9 : 9	0.8522	0.8228	LOGNORM	179.3720	190.7691	190.7691	380.0000	121.8889	190.7691
MCPP	1 : 9 : 9	0.4169	0.4619	LOGNORM	3.3597	3.1965	3.1965	7.8000	2.0389	3.1965
Mercury	9 : 9 : 9	0.7923	0.9076	LOGNORM	0.1942	0.3956	0.3956	0.3000	0.1258	0.3000
Molybdenum	3 : 9 : 9	0.5257	0.8293	LOGNORM	1.2840	1.1862	1.1862	3.1500	0.6956	1.1862
N-Nitrosodiphenylamine	1 : 6 : 9	0.5132	0.5405	LOGNORM				0.6000	0.1908	0.6000
Naphthalene	2 : 5 : 9	0.9222	0.8371	NORMAL				0.1600	0.1088	0.1600
Nickel	9 : 9 : 9	0.7302	0.8970	LOGNORM	804.6072	1260.5901	1260.5901	1500.0000	480.0000	1260.5901
Pentachlorophenol	9 : 9 : 9	0.6129	0.9399	LOGNORM	0.1171	0.1928	0.1928	0.2900	0.0637	0.1928
Phenanthrene	7 : 9 : 9	0.7824	0.9528	LOGNORM	0.7209	5.0657	5.0657	1.4000	0.4162	1.4000
Potassium	9 : 9 : 9	0.9316	0.9697	LOGNORM	1020.5018	1119.7765	1119.7765	1500.0000	812.7778	1119.7765
Pyrene	3 : 9 : 9	0.8485	0.8202	NORMAL	1.0072	3.6700	1.0072	1.7000	0.6361	1.0072
Silver	7 : 9 : 9	0.7511	0.8785	LOGNORM	2.7798	4.6068	4.6068	5.6000	1.6656	4.6066
Sodium	8 : 9 : 9	0.8906	0.9084	LOGNORM	159.6107	198.2361	198.2361	260.0000	121.5556	198.2361

Table A-1
 Summary Statistics and Selection of EPC for COPCs in Creek Bottom Soils
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

Chemical	Frequency of Detection	Shapiro-Wilks Test for Normality (a)			95% Upper Confidence Limit			Maximum Detect	Arithmetic Mean	EPC (c)
		Normal	Lognormal	Dataset Distribution	(t-test) Norm	H-test (Lognorm)	UCL (b)			
Tin	4 : 9 : 9	0.6788	0.7832	LOGNORM	11.4403	14.5133	14.5133	20.0000	7.3278	14.5133
Toluene	8 : 9 : 9	0.6507	0.8758	LOGNORM	0.0179	0.0277	0.0277	0.0420	0.0101	0.0277
Total PCBs	9 : 9 : 9	0.8080	0.9343	LOGNORM	10.6062	24.7573	24.7573	27.1380	5.3980	24.7573
Vanadium	9 : 9 : 9	0.8508	0.8813	LOGNORM	16.3108	17.8363	17.8363	23.0000	13.2000	17.8363
Xylenes (total)	5 : 9 : 9	0.7955	0.8286	LOGNORM	0.0777	1.2296	1.2296	0.1600	0.0440	0.1600
Zinc	9 : 9 : 9	0.7413	0.9836	LOGNORM	5338.9190	11560.6606	11560.6606	12000.0000	3088.8889	11560.6606

Notes:
 EPC - Exposure Point Concentration.
 UCL - Upper Confidence Limit.
 (a) - The results of the Shapiro-Wilks test for normality indicates whether the data set is more likely to be normally or lognormally distributed. The data set is considered to be normally distributed if the test result is higher in the column labeled "NORMAL". The data set is considered to be lognormally distributed if the test result is higher in the column labeled "LOGNORMAL".
 (b) - 95% UCL is selected based on whether the data set is normally or lognormally distributed. The UCL based on the t-statistic is chosen for a normal distribution, and the UCL based on the H-statistic is chosen if the data are lognormally distributed.
 (c) - The EPC for sediment is the lower of the selected 95% UCL and the Maximum Detected Concentration.

Table A-2
Calculation of Total PCBs
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment Sample	B CBS-CSB-T0-C1	B CBS-CSB-T1-C1	B CBS-CSB-T1-E1	B CBS-CSB-T1-W1	B CBS-CSB-T10-C1	B CBS-CSB-T10-E1	B CBS-CSB-T10-W1	B CBS-CSB-T11-C1
Sample date	11/1/01	10/31/01	10/31/01	10/31/01	11/8/01	11/8/01	11/8/01	11/19/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	1.3	0.025 U	0.015 J	0.023 J	0.024 U	0.0041 J	0.022 U	0.041 J
Dichlorobiphenyl	0.3	0.0035 J	0.0032 J	0.0088	0.0047 U	0.0044 UJ	0.0044 U	0.0038 J
Heptachlorobiphenyl	4	0.015 U	0.16	0.13	0.014 U	0.014 UJ	0.014 U	0.02 J
Hexachlorobiphenyl	4.8	0.0071 J	0.26	0.18	0.0024 J	0.0085 J	0.0063 J	0.041 J
Monochlorobiphenyl	0.024 U	0.005 U	0.0048 U	0.0046 U	0.0047 U	0.0044 UJ	0.0044 U	0.0046 UJ
Nonachlorobiphenyl	0.074 U	0.025 U	0.024 U	0.024 U	0.024 U	0.022 UJ	0.022 U	0.015 J
Octachlorobiphenyl	1.1	0.015 U	0.042	0.036	0.014 U	0.014 UJ	0.014 U	0.0068 J
Pentachlorobiphenyl	12	0.024	0.6	0.34	0.014	0.041 J	0.025	0.19 J
Tetrachlorobiphenyl	5.5	0.0088 J	0.5 J	0.42	0.0096 U	0.018 J	0.026	0.17 J
Trichlorobiphenyl	0.73	0.0018 J	0.073 J	0.082	0.0047 U	0.0014 J	0.0035 J	0.032 J
Total PCBs (a)	29.73	0.0852	1.6652	1.2318	0.0639	0.1024	0.1012	0.78605

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
 Calculation of Total PCBs
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

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Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T11-C1-D	CBS-CSB-T11-E1	CBS-CSB-T11-W1	CBS-CSB-T12-C1	CBS-CSB-T12-E1	CBS-CSB-T12-W1	CBS-CSB-T13-C1	CBS-CSB-T13-E1
Sample date	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.055 J	0.008 J	0.0088 J	0.025 UJ	0.01 J	0.0058 J	0.023 UJ	0.02 UJ
Dichlorobiphenyl	0.0065 J	0.004 UJ	0.0042 UJ	0.0075 J	0.0039 UJ	0.0043 UJ	0.0046 UJ	0.0039 UJ
Heptachlorobiphenyl	0.046 J	0.012 UJ	0.015 J	0.012 UJ	0.012 UJ	0.013 UJ	0.014 UJ	0.012 UJ
Hexachlorobiphenyl	0.051 J	0.0097 J	0.012 J	0.01 UJ	0.015 J	0.015 J	0.0093 UJ	0.0046 J
Monochlorobiphenyl	0.0045 UJ	0.004 UJ	0.0042 UJ	0.0049 UJ	0.0039 UJ	0.0043 UJ	0.0046 UJ	0.0039 UJ
Nonachlorobiphenyl	0.02 J	0.0051 J	0.021 UJ	0.025 UJ	0.0063 J	0.022 UJ	0.023 UJ	0.02 UJ
Octachlorobiphenyl	0.015 J	0.012 UJ	0.0034 J	0.015 UJ	0.0011 J	0.013 UJ	0.014 UJ	0.012 UJ
Pentachlorobiphenyl	0.23 J	0.034 J	0.11 J	0.0014 J	0.044 J	0.035 J	0.0093 UJ	0.014 J
Tetrachlorobiphenyl	0.49 J	0.02 J	0.13 J	0.01 UJ	0.046 J	0.087 J	0.0093 UJ	0.0093 J
Trichlorobiphenyl	0.14 J	0.0043 J	0.02 J	0.023 J	0.007 J	0.017 J	0.0046 UJ	0.0016 J
Total PCBs (a)		0.0971	0.3139	0.0819	0.1393	0.1879	0.05555 U	0.0654

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
 detection limit is estimated.

R - Rejected.

(a) - Calculated in
 accordance with the steps
 outlined in Section 3.1.3

and 4.4 of the human
 health risk assessment.

Note that totals are not
 presented for duplicates;
 the total for the parent
 sample is the average total
 of the sample and the
 duplicate.

Table A-
Calculation of Total PCBs
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B CBS-CSB-T13-W1	B CBS-CSB-T14-1	B CBS-CSB-T15-1	B CBS-CSB-T16-1	B CBS-CSB-T17-C1	B CBS-CSB-T17-E1	B CBS-CSB-T17-E1D	B CBS-CSB-T17-W1
Sample	11/19/01 mg/kg	12/20/01 mg/kg	12/20/01 mg/kg	12/20/01 mg/kg	11/9/01 mg/kg	11/9/01 mg/kg	11/9/01 mg/kg	11/9/01 mg/kg
Decachlorobiphenyl	0.022 UJ	0.026 U	0.0083 J	0.0074 J	0.027 U	0.016 J	0.051 J	0.024 U
Dichlorobiphenyl	0.0044 UJ	0.0051 U	0.0043 U	0.0048 U	0.0053 U	0.0048 UJ	0.014 J	0.0048 U
Heptachlorobiphenyl	0.014 UJ	0.015 U	0.0026 J	0.0038 J	0.016 U	0.019 J	0.081 J	0.014 U
Hexachlorobiphenyl	0.004 J	0.01 U	0.0044 J	0.012	0.011 U	0.045 J	0.11 J	0.0094 U
Monochlorobiphenyl	0.0044 UJ	0.0051 U	0.0043 U	0.0048 U	0.0053 U	0.0048 UJ	0.0022 J	0.0046 U
Nonachlorobiphenyl	0.022 UJ	0.026 U	0.0028 J	0.024 U	0.027 U	0.024 UJ	0.023 U	0.024 U
Octachlorobiphenyl	0.014 UJ	0.015 U	0.013 U	0.014 U	0.016 U	0.0051 J	0.023 J	0.014 U
Pentachlorobiphenyl	0.013 J	0.01 U	0.042	0.078	0.011 U	0.17 J	0.68 J	0.0094 U
Tetrachlorobiphenyl	0.019 J	0.01 U	0.036	0.016	0.011 U	0.085 J	0.21 J	0.0094 U
Trichlorobiphenyl	0.0028 J	0.0051 U	0.0043 U	0.0028 J	0.0053 U	0.018 J	0.049 J	0.0046 U
Total PCBs (a)	0.0792	0.0611 U	0.10905	0.1414	0.0648 U	0.8032		0.0567 U

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T18-C1	CBS-CSB-T18-E1	CBS-CSB-T18-W1	CBS-CSB-T18-W1D	CBS-CSB-T2-C1	CBS-CSB-T2-E1	CBS-CSB-T2-W1	CBS-CSB-T3-C1
Sample date	11/9/01	11/9/01	11/9/01	11/9/01	10/31/01	10/31/01	10/31/01	10/31/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.022 UJ	0.023 U	0.023 U	0.022 UJ	0.026 UJ	0.017 J	0.023 UJ	1.4 U
Dichlorobiphenyl	0.0044 UJ	0.0046 U	0.0045 U	0.0044 UJ	0.0052 UJ	0.0046 UJ	0.0044 UJ	0.27
Heptachlorobiphenyl	0.014 UJ	0.014 UJ	0.014 U	0.014 UJ	0.016 UJ	0.019 J	0.013 UJ	0.86 U
Hexachlorobiphenyl	0.009 UJ	0.0093 UJ	0.0092 U	0.009 UJ	0.011 UJ	0.04 J	0.0089 UJ	0.14
Monochlorobiphenyl	0.0044 UJ	0.0046 U	0.0045 U	0.0044 UJ	0.0052 UJ	0.0046 UJ	0.0044 UJ	0.28 U
Nonachlorobiphenyl	0.022 UJ	0.023 U	0.023 U	0.022 UJ	0.026 UJ	0.024 UJ	0.023 UJ	1.4 U
Octachlorobiphenyl	0.014 UJ	0.014 UJ	0.014 U	0.014 UJ	0.016 UJ	0.0047 J	0.013 UJ	0.86 U
Pentachlorobiphenyl	0.009 UJ	0.0093 U	0.0092 U	0.009 UJ	0.011 UJ	0.15 J	0.0089 UJ	0.77
Tetrachlorobiphenyl	0.009 UJ	0.0093 U	0.0092 U	0.009 UJ	0.011 UJ	0.018 J	0.0089 UJ	3.2
Trichlorobiphenyl	0.0044 UJ	0.0046 U	0.0045 U	0.0044 UJ	0.0021 J	0.0046 UJ	0.0044 UJ	2
Total PCBs (a)	0.0561 U	0.05555 U	0.0568 U		0.0632	0.2653	0.05595 U	7.94

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.

Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment Sample	B CBS-CSB-T3-E1	B CBS-CSB-T3-W1	B CBS-CSB-T4-C1	B CBS-CSB-T4-E1	B CBS-CSB-T4-W1	B CBS-CSB-T5-C1	B CBS-CSB-T5-E1	B CBS-CSB-T5-W1
Sample date	10/31/01	10/31/01	11/1/01	11/1/01	11/1/01	11/1/01	11/1/01	11/1/01
Units Analyte:	mg/kg							
Decachlorobiphenyl	1 U	0.023 UJ	R	0.01 J	0.025 UJ	0.0063 J	0.025 J	0.023 U
Dichlorobiphenyl	0.2 U	0.025 J	0.0022 J	0.0046 UJ	0.0049 UJ	0.0048 U	0.029 J	0.0045 U
Heptachlorobiphenyl	0.63 U	0.014 UJ	R	0.016 J	0.015 UJ	0.015 U	0.04 J	0.014 U
Hexachlorobiphenyl	0.83	0.0034 J	R	0.054 J	0.01 UJ	0.011	0.15 J	0.0092 U
Monochlorobiphenyl	0.2 U	0.0045 UJ	R	0.0046 UJ	0.0049 UJ	0.0048 U	0.0087 UJ	0.0045 U
Nonachlorobiphenyl	1 U	0.023 UJ	R	0.023 UJ	0.025 UJ	0.024 U	0.044 UJ	0.023 U
Octachlorobiphenyl	0.63 U	0.014 UJ	R	0.031 J	0.015 UJ	0.015 U	0.013 J	0.014 U
Pentachlorobiphenyl	18	0.031 J	0.015 J	0.15 J	0.0013 J	0.042	0.84 J	0.0092 U
Tetrachlorobiphenyl	51	0.063 J	0.025 J	0.056 J	0.0016 J	0.027	1 J	0.0092 U
Trichlorobiphenyl	15	0.12 J	0.0045 J	0.002 J	0.0032 J	0.024	0.48 J	0.0045 U
Total PCBs (a)	86.66	0.2694	0.0467	0.3328	0.05355	0.1387	2.577	0.0553 U

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3

and 4.4 of the human
health risk assessment.

Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B CBS-CSB-T6-C1	B CBS-CSB-T6-C1-D	B CBS-CSB-T6-E1	B CBS-CSB-T6-W1	B CBS-CSB-T7-C1	B CBS-CSB-T7-E1	B CBS-CSB-T7-W1	B CBS-CSB-T8-C1
Sample	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.0043 J	0.023 UJ	0.018 J	0.022 UJ	0.022 UJ	0.022 UJ	0.021 UJ	0.009 J
Dichlorobiphenyl	0.0046 U	0.0046 UJ	0.0028 J	0.0043 UJ	0.0044 UJ	0.0044 UJ	0.0042 UJ	0.0036 J
Heptachlorobiphenyl	0.014 U	0.014 UJ	0.014 J	0.013 UJ	0.014 UJ	0.013 UJ	0.0029 J	0.0048 J
Hexachlorobiphenyl	0.0093 U	0.0014 J	0.038 J	0.0088 UJ	0.0021 J	0.0015 J	0.0092 J	0.019 J
Monochlorobiphenyl	0.0046 U	0.0046 UJ	0.0038 UJ	0.0043 UJ	0.0044 UJ	0.0044 UJ	0.0042 UJ	0.0046 UJ
Nonachlorobiphenyl	0.023 U	0.023 UJ	0.019 UJ	0.022 UJ	0.022 UJ	0.022 UJ	0.021 UJ	0.023 UJ
Octachlorobiphenyl	0.014 U	0.014 UJ	0.0045 J	0.013 UJ	0.014 UJ	0.013 UJ	0.013 UJ	0.014 UJ
Pentachlorobiphenyl	0.0064 J	0.0071 J	0.24 J	0.0088 UJ	0.02 J	0.0051 J	0.074 J	0.11 J
Tetrachlorobiphenyl	0.013	0.0096 J	0.37 J	0.0088 UJ	0.028 J	0.0089 UJ	0.061 J	0.15 J
Trichlorobiphenyl	0.0053	0.0028 J	0.074 J	0.0018 J	0.0054 J	0.0044 UJ	0.0081 J	0.022 J
Total PCBs (a)	0.060825		0.7727	0.0543	0.0959	0.05265	0.1869	0.3369

Notes:

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(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B CBS-CSB-T8-E1	B CBS-CSB-T8-W1	B CBS-CSB-T9-C1	B CBS-CSB-T9-E1	B CBS-CSB-T9-W1	C CBS-CSC-T1-1	C CBS-CSC-T2-1	C CBS-CSC-T3-1
Sample	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	12/13/01	12/13/01	12/13/01
Sample date								
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.024 UJ	0.022 UJ	0.022 UJ	0.0028 J	0.0027 J	0.023 U	0.029	0.026 U
Dichlorobiphenyl	0.0047 UJ	0.0044 UJ	0.0044 UJ	0.0043 UJ	0.0043 U	0.0045 U	0.0079	0.0051 U
Heptachlorobiphenyl	0.014 UJ	0.014 UJ	0.014 UJ	0.013 UJ	0.0022 J	0.014 U	0.018	0.015 U
Hexachlorobiphenyl	0.0096 UJ	0.0023 J	0.009 UJ	0.0021 J	0.0084 J	0.0092 U	0.038	0.01 U
Monochlorobiphenyl	0.0047 UJ	0.0044 UJ	0.0044 UJ	0.0043 UJ	0.0043 U	0.0045 U	0.0014 J	0.0051 U
Nonachlorobiphenyl	0.024 UJ	0.022 UJ	0.022 UJ	0.022 UJ	0.022 U	0.023 U	0.011 J	0.026 U
Octachlorobiphenyl	0.014 UJ	0.014 UJ	0.014 UJ	0.013 UJ	0.013 U	0.014 U	0.011 J	0.015 U
Pentachlorobiphenyl	0.0096 UJ	0.017 J	0.009 UJ	0.0088 J	0.043	0.0011 J	0.027	0.0029 J
Tetrachlorobiphenyl	0.0096 UJ	0.029 J	0.009 UJ	0.0088 UJ	0.064	0.0092 U	0.03	0.01 U
Trichlorobiphenyl	0.0047 UJ	0.0045 J	0.0044 UJ	0.0043 UJ	0.0069	0.0045 U	0.0049	0.0051 U
Total PCBs (a)	0.0571 U	0.0932	0.0561 U	0.04855	0.149	0.0403	0.1782	0.046

Notes:

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(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	C CBS-CSC-T4-1	C CBS-CSC-T4-1-FD	C CBS-CSC-T5-1	C CBS-CSC-T6-1	C CBS-CSC-T7-1	C CBS-CSC-T8-1	C CBS-CSC-T9-1	D CBS-CSD-T1-1
Sample	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/12/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.025 U	0.0089 J	0.026 U	0.021 J	0.024 U	0.025 U	0.022 U	0.025 U
Dichlorobiphenyl	0.0049 U	0.005 U	0.0052 U	0.0052 U	0.0048 U	0.0049 U	0.0044 U	0.0049 U
Heptachlorobiphenyl	0.015 U	0.015 U	0.016 U	0.0036 J	0.015 U	0.015 U	0.014 U	0.015 U
Hexachlorobiphenyl	0.0034 J	0.015	0.01 U	0.01 J	0.0098 U	0.0073 J	0.009 U	0.01 U
Monochlorobiphenyl	0.0049 U	0.005 U	0.0052 U	0.0052 U	0.0048 U	0.0049 U	0.0044 U	0.0049 U
Nonachlorobiphenyl	0.025 U	0.025 U	0.026 U	0.0052 J	0.024 U	0.025 U	0.022 U	0.025 U
Octachlorobiphenyl	0.015 U	0.015 U	0.016 U	0.016 U	0.015 U	0.015 U	0.014 U	0.015 U
Pentachlorobiphenyl	0.0059 J	0.032	0.01 U	0.024	0.0098 U	0.017	0.009 U	0.01 U
Tetrachlorobiphenyl	0.01 U	0.0068 J	0.01 U	0.0068 J	0.0098 U	0.0023 J	0.009 U	0.01 U
Trichlorobiphenyl	0.0049 U	0.005 U	0.0052 U	0.0052 U	0.0048 U	0.0049 U	0.0044 U	0.0049 U
Total PCBs (a)	0.0647		0.0492 U	0.0838	0.0465 U	0.059	0.0539 U	0.0599 U

Notes:

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UJ - Nondetected,
detection limit is estimated.

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(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3

and 4.4 of the human
health risk assessment.

Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	D CBS-CSD-T2-1	D CBS-CSD-T3-1	D CBS-CSD-T4-1	D CBS-CSD-T5-1	D CBS-CSD-T6-1	E CBS-CSE-T1-1	E CBS-CSE-T10-1	E CBS-CSE-T11-1
Sample	12/12/01	12/12/01	12/12/01	12/12/01	12/12/01	12/18/01	12/19/01	12/19/01
Units	mg/kg	mg/kg						
Decachlorobiphenyl	0.059	0.004 J	0.025 U	0.023 U	0.19	0.0074 J	0.023 UJ	0.0079 J
Dichlorobiphenyl	0.005 U	0.0047 U	0.0049 U	0.0045 U	0.0048 U	0.0049 U	0.0046 UJ	0.0048 U
Heptachlorobiphenyl	0.026	0.014 U	0.015 U	0.014 U	0.19	0.015 U	0.014 UJ	0.015 U
Hexachlorobiphenyl	0.063	0.0015 J	0.0033 J	0.0027 J	0.62	0.0067 J	0.0093 UJ	0.01
Monochlorobiphenyl	0.0039 J	0.0047 U	0.0049 U	0.0045 U	0.0048 U	0.0049 U	0.0046 UJ	0.0048 U
Nonachlorobiphenyl	0.016 J	0.024 U	0.025 U	0.023 U	0.039	0.025 U	0.023 UJ	0.024 U
Octachlorobiphenyl	0.0099 J	0.014 U	0.015 U	0.014 U	0.05	0.015 U	0.014 UJ	0.015 U
Pentachlorobiphenyl	0.06	0.0044 J	0.0057 J	0.0047 J	1	0.0091 J	0.0093 UJ	0.018
Tetrachlorobiphenyl	0.033	0.0096 U	0.01 U	0.0092 U	0.34	0.01 U	0.0093 UJ	0.0098 U
Trichlorobiphenyl	0.021	0.0047 U	0.0049 U	0.0045 U	0.0082	0.0049 U	0.0046 UJ	0.0048 U
Total PCBs (a)	0.2918	0.0454	0.0589	0.0535	2.4396	0.0606	0.05555 U	0.0726

Notes:

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UJ - Nondetected,
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(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	E CBS-CSE-T12-1	E CBS-CSE-T13-2	E CBS-CSE-T14-1	E CBS-CSE-T15-1	E CBS-CSE-T15-1-FD	E CBS-CSE-T16-1	E CBS-CSE-T17-1	E CBS-CSE-T2-1
Sample	12/19/01	2/14/02	12/18/01	12/18/01	12/18/01	12/21/01	12/21/01	12/18/01
Sample date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.026 U	0.064	0.024 U	0.021 U	0.021 U	0.18	0.017 J	0.022 U
Dichlorobiphenyl	0.0051 U	0.0049 U	0.0048 U	0.0042 U	0.0042 U	0.0057 J	0.0058 U	0.0044 U
Heptachlorobiphenyl	0.015 U	0.041	0.015 U	0.013 U	0.013 U	0.064 J	0.0059 J	0.014 U
Hexachlorobiphenyl	0.01 U	0.24	0.0098 U	0.0085 U	0.0086 U	0.082 J	0.012	0.0095
Monochlorobiphenyl	0.0051 U	0.0049 U	0.0048 U	0.0042 U	0.0042 U	0.0067 UJ	0.0058 U	0.0044 U
Nonachlorobiphenyl	0.028 U	0.035	0.024 U	0.021 U	0.021 U	0.094	0.0039 J	0.022 U
Octachlorobiphenyl	0.015 U	0.016	0.015 U	0.013 U	0.013 U	0.032	0.018 U	0.014 U
Pentachlorobiphenyl	0.01 U	0.38 J	0.0098 U	0.0085 U	0.0086 U	0.57 J	0.061	0.018
Tetrachlorobiphenyl	0.01 U	0.14	0.0098 U	0.0085 U	0.0086 U	0.16 J	0.0038 J	0.0024 J
Trichlorobiphenyl	0.0051 U	0.0011 J	0.0048 U	0.0042 U	0.0042 U	0.064 J	0.0058 U	0.0044 U
Total PCBs (a)	0.0611 U	0.91955	0.0585 U	0.051025 U		1.2517	0.1182	0.0703

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.4 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-2
Calculation of Total PCBs
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	E CBS-CSE-T3-1	E CBS-CSE-T3-1-FD	E CBS-CSE-T4-1	E CBS-CSE-T5-1	E CBS-CSE-T6-1	E CBS-CSE-T7-1	E CBS-CSE-T8-1	E CBS-CSE-T9-1
Sample	12/18/01	12/18/01	12/18/01	12/18/01	12/18/01	12/19/01	12/19/01	12/19/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.024 U	0.024 U	0.023 U	0.022 U	0.0084 J	0.024 U	0.0062 J	0.025 U
Dichlorobiphenyl	0.0048 U	0.0046 U	0.0046 U	0.0043 U	0.0047 U	0.0048 U	0.0052 U	0.0049 U
Heptachlorobiphenyl	0.015 U	0.014 U	0.014 U	0.013 U	0.014 U	0.014 U	0.016 U	0.015 U
Hexachlorobiphenyl	0.0098 U	0.0094 U	0.0093 U	0.0013 J	0.018	0.0097 U	0.0077 J	0.01 U
Monochlorobiphenyl	0.0048 U	0.0046 U	0.0046 U	0.0043 U	0.0047 U	0.0048 U	0.0052 U	0.0049 U
Nonachlorobiphenyl	0.024 U	0.024 U	0.023 U	0.022 U	0.024 U	0.024 U	0.026 U	0.025 U
Octachlorobiphenyl	0.015 U	0.014 U	0.014 U	0.013 U	0.014 U	0.014 U	0.016 U	0.015 U
Pentachlorobiphenyl	0.0044 J	0.0025 J	0.0093 U	0.0011 J	0.046	0.0097 U	0.015	0.01 U
Tetrachlorobiphenyl	0.0098 U	0.0094 U	0.0093 U	0.0087 U	0.012	0.0097 U	0.011 U	0.01 U
Trichlorobiphenyl	0.0048 U	0.0046 U	0.0046 U	0.0043 U	0.0011 J	0.0048 U	0.0052 U	0.0049 U
Total PCBs (a)	0.05625		0.05555 U	0.04605	0.11385	0.05735 U	0.0688	0.0599 U

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
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(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.

Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	F CBS-CSF-T1-1	F CBS-CSF-T10-1	F CBS-CSF-T11-1	F CBS-CSF-T12-1	F CBS-CSF-T13-1	F CBS-CSF-T14-1	F CBS-CSF-T15-1	F CBS-CSF-T15-1-FD
Sample	12/21/01	1/25/02	1/25/02	1/23/02	1/16/02	1/8/02	1/8/02	1/8/02
Sample date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.028 U	0.022 U	0.023 U	0.022 U	0.022 U	0.0081 J	0.0062 J	0.01 J
Dichlorobiphenyl	0.0055 U	0.0043 U	0.0046 U	0.0044 U	0.0044 U	0.0044 U	0.0047 U	0.0043 U
Heptachlorobiphenyl	0.017 U	0.013 U	0.014 U	0.014 U	0.013 U	0.014 U	0.014 U	0.013 U
Hexachlorobiphenyl	0.011 U	0.0087 U	0.0093 U	0.009 U	0.0089 U	0.0079 J	0.0065 J	0.0067 J
Monochlorobiphenyl	0.0055 U	0.0043 U	0.0046 U	0.0044 U	0.0044 U	0.0044 U	0.0047 U	0.0043 U
Nonachlorobiphenyl	0.028 U	0.022 U	0.023 U	0.022 U	0.022 U	0.022 U	0.024 U	0.0033 J
Octachlorobiphenyl	0.017 U	0.013 U	0.014 U	0.014 U	0.013 U	0.014 U	0.014 U	0.013 U
Pentachlorobiphenyl	0.011 U	0.0087 U	0.0093 U	0.009 U	0.0089 U	0.011	0.0058 J	0.0039 J
Tetrachlorobiphenyl	0.011 U	0.0087 U	0.0093 U	0.009 U	0.0089 U	0.009 U	0.0096 U	0.0088 U
Trichlorobiphenyl	0.0055 U	0.0043 U	0.0046 U	0.0044 U	0.0044 U	0.0044 U	0.0047 U	0.0043 U
Total PCBs (a)	0.0445 U	0.04585 U	0.04855 U	0.0469 U	0.04625 U	0.0519	0.04305	

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-1
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	F CBS-CSF-T16-1	F CBS-CSF-T2-1	F CBS-CSF-T3-1	F CBS-CSF-T4-1	F CBS-CSF-T5-1	F CBS-CSF-T6-1	F CBS-CSF-T6-1-FD	F CBS-CSF-T7-1
Sample	2/6/02	12/11/01	12/11/01	12/11/01	1/8/02	1/16/02	1/16/02	1/16/02
Sample date								
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.024 U	0.024 U	0.032	0.023 U	0.023 U	0.025 U	0.024 U	0.023 U
Dichlorobiphenyl	0.0047 U	0.0048 U	0.0051 U	0.0045 U	0.0046 U	0.0049 U	0.0047 U	0.0046 U
Heptachlorobiphenyl	0.014 U	0.015 U	0.016	0.014 U	0.014 U	0.015 U	0.014 U	0.014 U
Hexachlorobiphenyl	0.0096 U	0.0098 U	0.07	0.0092 U	0.0093 U	0.0047 J	0.0079 J	0.0049 J
Monochlorobiphenyl	0.0047 U	0.0048 U	0.0056	0.0045 U	0.0046 U	0.0049 U	0.0047 U	0.0046 U
Nonachlorobiphenyl	0.024 U	0.024 U	0.013 J	0.023 U	0.023 U	0.025 U	0.024 U	0.023 U
Octachlorobiphenyl	0.014 U	0.015 U	0.0062 J	0.014 U	0.014 U	0.015 U	0.014 U	0.014 U
Pentachlorobiphenyl	0.0096 U	0.0098 U	0.13	0.0092 U	0.0093 U	0.0087 J	0.017	0.0091 J
Tetrachlorobiphenyl	0.0096 U	0.0098 U	0.077	0.0092 U	0.0093 U	0.002 J	0.0079 J	0.0093 U
Trichlorobiphenyl	0.0047 U	0.0048 U	0.0071	0.0045 U	0.001 J	0.0049 U	0.0047 U	0.0046 U
Total PCBs (a)	0.0501 U	0.051 U	0.3569	0.0483 U	0.04725	0.06065		0.05325

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.

Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	F	F	F	SITE M	SITE M	SITE M	SITE M	SITE M
Sample	CBS-CSF-T9-1	CBS-CSF-T9-1	CBS-CSF-T9-1-FD	SED-M-S10 0-6	SED-M-S2 0-6	SED-M-S3-(0-6)	SED-M-S4-(0-6)	SED-M-S5 0-6
Sample date	1/23/02	1/23/02	1/23/02	6/22/01	6/22/01	7/10/01	8/1/01	6/22/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
Decachlorobiphenyl	0.023 U	0.0031 J	0.0033 J	0.52	0.024	0.28	0.15 J	0.03
Dichlorobiphenyl	0.0045 U	0.0049 U	0.0043 U	0.12	0.0045 U	0.16	0.038	0.0041 U
Heptachlorobiphenyl	0.014 U	0.015 U	0.013 U	1.1	0.013 J	0.078	0.23 J	0.054
Hexachlorobiphenyl	0.0092 U	0.0034 J	0.0033 J	0.52	0.065	0.088	0.045 J	0.11
Monochlorobiphenyl	0.0045 U	0.0049 U	0.0043 U	0.068	0.0045 U	0.066	0.0043 U	0.0041 U
Nonachlorobiphenyl	0.023 U	0.025 U	0.022 U	0.13 J	0.023 U	0.17	0.041	0.011 J
Octachlorobiphenyl	0.014 U	0.015 U	0.013 U	0.14 J	0.014 U	0.065	0.079 J	0.015
Pentachlorobiphenyl	0.0092 U	0.0032 J	0.0014 J	15	0.22	0.096	0.93	0.3
Tetrachlorobiphenyl	0.0092 U	0.01 U	0.0088 U	8.6	0.17	0.13	2	0.4
Trichlorobiphenyl	0.0045 U	0.0049 U	0.0043 U	0.94	0.04	0.16	0.81	0.083
Total PCBs (a)	0.0483 U	0.0369		27.138	0.555	1.293	4.32515	1.0071

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
detection limit is estimated.

R - Rejected.

(a) - Calculated in
accordance with the steps
outlined in Section 3.1.3
and 4.4 of the human
health risk assessment.
Note that totals are not
presented for duplicates;
the total for the parent
sample is the average total
of the sample and the
duplicate.

Table A-2
Calculation of Total PCBs
Sauget Area 1 - Creek Bottom Soils
Human Health Risk Assessment

Creek segment	SITE M SED-M-S6-(0-6)	SITE M SED-M-S7-(0-6)	SITE M SED-M-S7-FD(0-6)	SITE M SED-M-S8 0-6	SITE M SED-M-S9-(0-6)
Sample date	7/10/01	8/1/01	8/1/01	8/22/01	7/10/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:					
Decachlorobiphenyl	0.035	0.2 J	0.15 J	0.1	0.14
Dichlorobiphenyl	0.0049	0.085 U	0.086 U	0.041	0.0033 J
Heptachlorobiphenyl	0.1 J	0.46	0.26	0.11	0.23
Hexachlorobiphenyl	0.14 J	0.48	0.36	0.11	0.29
Monochlorobiphenyl	0.0042 U	0.085 U	0.086 U	0.029	0.0041 U
Nonachlorobiphenyl	0.022	0.067 J	0.023 J	0.057	0.052
Octachlorobiphenyl	0.037	0.16 J	0.12 J	0.027	0.061
Pentachlorobiphenyl	0.47	3.1	2.4	0.67	0.95
Tetrachlorobiphenyl	0.86	3.8	2.7	0.28	0.57
Trichlorobiphenyl	0.055 J	1.7	1.1	0.13	0.06
Total PCBs (a)	1.726	10.052	7.199	1.554	2.35835

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected,
 detection limit is estimated.

R - Rejected.

(a) - Calculated in
 accordance with the steps
 outlined in Section 3.1.3
 and 4.4 of the human
 health risk assessment.

Note that totals are not
 presented for duplicates;
 the total for the parent
 sample is the average total
 of the sample and the
 duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

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Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T0-C1	CBS-CSB-T1-C1	CBS-CSB-T1-E1	CBS-CSB-T1-W1	CBS-CSB-T2-C1	CBS-CSB-T2-E1	CBS-CSB-T2-W1	CBS-CSB-T3-C1
Sample date	11/1/01	10/31/01	10/31/01	10/31/01	10/31/01	10/31/01	10/31/01	10/31/01
Units	mg/kg							
Analyte:								
1,2,3,4,6,7,8,9-OCDD	2.49	0.0021 J	0.025	0.0679	0.0015 J	0.0208	0.00032 J	0.0316
1,2,3,4,6,7,8,9-OCDF	0.517	0.0007 J	0.0053 J	0.0226	0.00017 J	0.0042 J	0.00008 J	0.0032 J
1,2,3,4,6,7,8-HxCDD	0.21	0.00021 J	0.0021 J	0.0071	0.00005 U	0.002 J	0.00005 U	0.0021 J
1,2,3,4,6,7,8-HxCDF	0.0686	0.00008 J	0.00067 J	0.0025 J	0.00003 U	0.00079 J	0.00003 U	0.0011 J
1,2,3,4,7,8-HxCDF	0.0056	0.00003 U	0.00006 J	0.00015 J	0.00004 U	0.00003 U	0.00003 U	0.00013 J
1,2,3,4,7,8-HxCDD	0.0015 J	0.00003 U	0.00003 U	0.00004 U	0.00003 U	0.00002 U	0.00003 U	0.00006 U
1,2,3,4,7,8-HxCDF	0.0063	0.00002 U	0.00003 J	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00074 J
1,2,3,6,7,8-HxCDD	0.0065	0.00004 U	0.00007 J	0.00017 J	0.00004 U	0.00007 J	0.00004 U	0.00013 J
1,2,3,6,7,8-HxCDF	0.0029 J	0.00002 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 U	0.0003 J
1,2,3,7,8,9-HxCDD	0.0025 J	0.00003 U	0.00003 J	0.00008 J	0.00003 U	0.00002 U	0.00003 U	0.00014 J
1,2,3,7,8,9-HxCDF	0.0008 U	0.00002 U	0.00002 U	0.00003 U	0.00003 U	0.00002 U	0.00003 U	0.00004 U
1,2,3,7,8-PeCDD	0.0015 J	0.00004 U	0.00004 U	0.00004 U	0.00005 U	0.00004 U	0.00005 U	0.00021 J
1,2,3,7,8-PeCDF	0.0001 U	0.00003 U	0.00002 U	0.00003 U	0.00003 U	0.00002 U	0.00003 U	0.00009 J
2,3,4,6,7,8-HxCDF	0.0007 U	0.00003 U	0.00002 U	0.00003 U	0.00003 U	0.00002 U	0.00003 U	0.00004 U
2,3,4,7,8-PeCDF	0.0001 U	0.00003 U	0.00002 U	0.00003 U	0.00003 U	0.00002 U	0.00003 U	0.00004 U
2,3,7,8-TCDD	0.0001 U	0.00003 U	0.00003 U	0.00003 U	0.00004 U	0.00002 U	0.00003 U	0.00005 U
2,3,7,8-TCDF	0.00009 U	0.00002 U	0.00003 U					
Total HpCDD	0.457	0.00042 J	0.0042	0.0137	0.00005 U	0.0039	0.00005 U	0.0036 J
Total HpCDF	0.393	0.00041 J	0.003 J	0.0102	0.00003 U	0.0029 J	0.00003 U	0.0025 J
Total HxCDD	0.139 J	0.00003 U	0.00031 J	0.001 J	0.00003 U	0.00042 J	0.00003 U	0.0011 J
Total HxCDF	0.0761	0.00005 J	0.0005 J	0.0012 J	0.00002 U	0.00081 J	0.00002 U	0.0024 J
Total PeCDD	0.0228 J	0.00004 U	0.00004 U	0.00018 J	0.00005 U	0.00004 U	0.00005 U	0.001 J
Total PeCDF	0.0036 J	0.00003 U	0.00002 U	0.00007 J	0.00003 U	0.00002 U	0.00003 U	0.00083 J
Total TCDD	0.0532 J	0.0032 UJ	0.0033 UJ	0.0035 UJ	0.0037 UJ	0.0034 UJ	0.0031 UJ	0.0055 UJ
Total TCDF	0.0058	0.00006 UJ	0.00007 UJ	0.00002 U	0.00008 UJ	0.00002 U	0.00006 UJ	0.00018 J
2,3,7,8-TCDD-TEQ	0.0045447	0.00004108	0.00007433	0.0001683	0.000044017	0.00006905	0.000043338	0.00039878

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T3-E1	CBS-CSB-T3-W1	CBS-CSB-T4-C1	CBS-CSB-T4-E1	CBS-CSB-T4-W1	CBS-CSB-T5-C1	CBS-CSB-T5-E1	CBS-CSB-T5-W1
Sample date	10/31/01	10/31/01	11/1/01	11/1/01	11/1/01	11/1/01	11/1/01	11/1/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.463	0.0034 J	0.003 J	0.0073	0.00018 J	0.00072 J	0.0611	0.00023 J
1,2,3,4,6,7,8,9-OCDF	0.039	0.00062 J	0.00068 J	0.0012 J	0.00006 J	0.00019 J	0.0228	0.00007 U
1,2,3,4,6,7,8-HxCDD	0.0584	0.00027 J	0.00023 J	0.00055 J	0.00003 U	0.00004 U	0.0054	0.00004 U
1,2,3,4,6,7,8-HxCDF	0.0097	0.00007 U	0.00011 J	0.00026 J	0.00002 U	0.00003 U	0.0032 J	0.00002 U
1,2,3,4,7,8,9-HxCDF	0.00009 U	0.00008 U	0.00004 U	0.00002 U	0.00002 U	0.00003 U	0.00012 J	0.00003 U
1,2,3,4,7,8-HxCDD	0.00048 J	0.00007 U	0.00004 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 U
1,2,3,4,7,8-HxCDF	0.00033 J	0.00005 U	0.00003 U	0.00001 U	0.00001 U	0.00002 U	0.00008 J	0.00002 U
1,2,3,6,7,8-HxCDD	0.0015 J	0.00009 U	0.00004 U	0.00002 U	0.00002 U	0.00003 U	0.0002 J	0.00003 U
1,2,3,6,7,8-HxCDF	0.00006 U	0.00008 U	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U
1,2,3,7,8,9-HxCDD	0.0016 J	0.00008 U	0.00004 U	0.00002 U	0.00002 U	0.00003 U	0.00006 J	0.00002 U
1,2,3,7,8,9-HxCDF	0.00007 U	0.00006 U	0.00003 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 U
1,2,3,7,8-PeCDD	0.00028 J	0.00007 U	0.00005 U	0.00003 U	0.00003 U	0.00004 U	0.00003 U	0.00003 U
1,2,3,7,8-PeCDF	0.00011 J	0.00005 U	0.00003 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U
2,3,4,6,7,8-HxCDF	0.00007 U	0.00006 U	0.00003 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U
2,3,4,7,8-PeCDF	0.00031 J	0.00005 U	0.00003 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 U
2,3,7,8-TCDD	0.00006 U	0.00005 U	0.00003 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U
2,3,7,8-TCDF	0.00063 J	0.00004 U	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00004 J	0.00002 U
Total HpCDD	0.0986	0.00049 J	0.00043 J	0.0011 J	0.00003 U	0.00004 U	0.0102	0.00004 U
Total HpCDF	0.0415	0.00028 J	0.00042 J	0.00087 J	0.00002 U	0.00004 J	0.0138	0.00002 U
Total HxCDD	0.0101	0.00007 U	0.00004 U	0.0003 J	0.00002 U	0.00003 U	0.0013 J	0.00002 U
Total HxCDF	0.0214	0.00005 U	0.00013 J	0.00034 J	0.00001 U	0.00002 U	0.0027 J	0.00002 U
Total PeCDD	0.0028 J	0.00007 U	0.00005 U	0.00003 U	0.00003 U	0.00004 U	0.00059 J	0.00003 U
Total PeCDF	0.0019 J	0.00005 U	0.00003 U	0.00002 U	0.00002 U	0.00002 U	0.00022 J	0.00002 U
Total TCDD	0.0078 UJ	0.0028 UJ	0.0032 UJ	0.0027 UJ	0.0028 UJ	0.0028 UJ	0.0032 UJ	0.0026 UJ
Total TCDF	0.00063 J	0.0001 UJ	0.00009 UJ	0.00007 UJ	0.00009 UJ	0.00009 UJ	0.0002 UJ	0.0001 UJ
2,3,7,8-TCDD-TEQ	0.00163465	0.000075102	0.000048218	0.00003505	0.000026374	0.000037091	0.00015709	0.0000264765

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T6-C1	CBS-CSB-T6-C1-D	CBS-CSB-T6-E1	CBS-CSB-T6-W1	CBS-CSB-T7-C1	CBS-CSB-T7-E1	CBS-CSB-T7-W1	CBS-CSB-T8-C1
Sample date	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.014	0.011	0.0075	0.0011 J	0.00069 J	0.003 J	0.0166 J	0.00054 J
1,2,3,4,6,7,8,9-OCDF	0.0042 J	0.0046 J	0.00079 J	0.00039 J	0.00014 J	0.00024 J	0.0013 J	0.0002 J
1,2,3,4,6,7,8-HxCDD	0.0012 J	0.00091 J	0.00067 J	0.00013 J	0.00007 U	0.00011 J	0.0012 J	0.00006 U
1,2,3,4,6,7,8-HxCDF	0.00068 J	0.0006 J	0.00023 J	0.00006 J	0.00003 J	0.00006 J	0.00038 J	0.00004 J
1,2,3,4,7,8,9-HxCDF	0.00006 U	0.00007 U	0.00003 U	0.00005 U	0.00003 U	0.00004 U	0.00004 U	0.00004 U
1,2,3,4,7,8-HxCDD	0.00007 U	0.00008 U	0.00003 U	0.00005 U	0.00004 U	0.00004 U	0.00004 U	0.00005 U
1,2,3,4,7,8-HxCDF	0.00005 U	0.00006 U	0.00003 U	0.00004 U	0.00003 U	0.00003 U	0.00003 U	0.00003 U
1,2,3,6,7,8-HxCDD	0.00008 U	0.0001 U	0.00003 J	0.00006 U	0.00006 U	0.00005 U	0.00004 J	0.00006 U
1,2,3,6,7,8-HxCDF	0.00005 U	0.00006 U	0.00003 U	0.00004 U	0.00003 U	0.00003 U	0.00003 U	0.00003 U
1,2,3,7,8,9-HxCDD	0.00007 U	0.00008 U	0.00003 J	0.00005 U	0.00004 U	0.00004 U	0.00004 U	0.00005 U
1,2,3,7,8,9-HxCDF	0.00005 U	0.00007 U	0.00003 U	0.00005 U	0.00003 U	0.00003 U	0.00003 U	0.00003 U
1,2,3,7,8-PeCDD	0.0001 U	0.0001 U	0.00006 U	0.00008 U	0.00008 U	0.00009 U	0.00007 U	0.00009 U
1,2,3,7,8-PeCDF	0.00009 U	0.0001 U	0.00005 U	0.00005 U	0.00005 U	0.00006 U	0.00004 U	0.00006 U
2,3,4,6,7,8-HxCDF	0.00008 U	0.00007 U	0.00003 U	0.00005 U	0.00003 U	0.00004 U	0.00004 U	0.00004 U
2,3,4,7,8-PeCDF	0.0001 U	0.0001 U	0.00005 U	0.00005 U	0.00005 U	0.00006 U	0.00004 U	0.00006 U
2,3,7,8-TCDD	0.00009 U	0.00009 U	0.00005 U	0.00005 U	0.00006 U	0.00006 U	0.00004 U	0.00006 U
2,3,7,8-TCDF	0.00007 U	0.00009 U	0.00004 U	0.00004 U	0.00004 U	0.00004 U	0.00003 U	0.00004 U
Total HpCDD	0.0023 J	0.0017 J	0.0014 J	0.00024 J	0.00007 U	0.00024 J	0.0023 J	0.00008 U
Total HpCDF	0.0023 J	0.0018 J	0.00066 J	0.00022 J	0.00009 J	0.00017 J	0.0012 J	0.00013 J
Total HxCDD	0.00019 J	0.00031 J	0.00022 J	0.00005 U	0.00004 U	0.00004 U	0.00032 J	0.00005 U
Total HxCDF	0.00048 J	0.00023 J	0.00045 J	0.00004 U	0.00003 U	0.00003 U	0.00058 J	0.00003 U
Total PeCDD	0.0001 U	0.0001 U	0.00008 J	0.00006 U	0.00008 U	0.00009 U	0.00007 U	0.00009 U
Total PeCDF	0.00009 U	0.0001 U	0.00005 U	0.00005 U	0.00005 U	0.00006 U	0.00004 U	0.0011 J
Total TCDD	0.0029 UJ	0.0024 UJ	0.0024 UJ	0.0031 UJ	0.0029 UJ	0.0027 UJ	0.0026 UJ	0.0031 UJ
Total TCDF	0.00007 U	0.00013 J	0.00047 J	0.00004 U	0.00007 J	0.00006 J	0.00007 J	0.00008 J
2,3,7,8-TCDD-TEQ	0.00012109		0.000077729	0.000072549	0.000067633	0.000077224	0.00007829	0.000077574

Notes:
 J - Detected, estimated.
 U - Nondetected.
 UJ - Nondetected, detection limit is estimated.
 R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-5
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T8-E1	CBS-CSB-T8-W1	CBS-CSB-T9-C1	CBS-CSB-T9-E1	CBS-CSB-T9-W1	CBS-CSB-T10-C1	CBS-CSB-T10-E1	CBS-CSB-T10-W1
Sample date	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01	11/8/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0029 J	0.0071	0.00017 J	0.0054 J	0.0092	0.0011 J	0.0237	0.0138
1,2,3,4,6,7,8,9-OCDF	0.00046 J	0.00063 J	0.00004 J	0.0014 J	0.0011 J	0.00054 J	0.0103	0.0042 J
1,2,3,4,6,7,8-HxCDD	0.00018 J	0.00065 J	0.00002 U	0.00052 J	0.00093 J	0.0001 J	0.0025 J	0.0015 J
1,2,3,4,6,7,8-HxCDF	0.00011 J	0.00023 J	0.000009 U	0.00036 J	0.00034 J	0.00009 J	0.0017 J	0.00097 J
1,2,3,4,7,8,9-HxCDF	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00007 J	0.00002 U
1,2,3,4,7,8-HxCDD	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U
1,2,3,4,7,8-HxCDF	0.000007 U	0.000008 U	0.000007 U	0.000008 U	0.000007 U	0.000007 U	0.00004 J	0.00002 J
1,2,3,6,7,8-HxCDD	0.00001 U	0.00003 J	0.00001 U	0.00001 U	0.00003 J	0.00001 U	0.00009 J	0.00006 J
1,2,3,6,7,8-HxCDF	0.000007 U	0.000007 U	0.000006 U	0.000008 U	0.000007 U	0.000007 U	0.000009 U	0.00001 U
1,2,3,7,8,9-HxCDD	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 J	0.00001 U	0.00002 U	0.00004 J
1,2,3,7,8,9-HxCDF	0.000008 U	0.000009 U	0.000007 U	0.000009 U	0.000008 U	0.000008 U	0.00001 U	0.00001 U
1,2,3,7,8-PeCDD	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U	0.00003 U
1,2,3,7,8-PeCDF	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U
2,3,4,6,7,8-HxCDF	0.000008 U	0.000009 U	0.000008 U	0.00001 U	0.000008 U	0.000008 U	0.00001 U	0.00001 U
2,3,4,7,8-PeCDF	0.00002 U	0.00002 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U
2,3,7,8-TCDD	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U
2,3,7,8-TCDF	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U
Total HpCDD	0.00037 J	0.0012 J	0.00002 U	0.0011 J	0.0018 J	0.0002 J	0.0047	0.0028 J
Total HpCDF	0.00034 J	0.00069 J	0.00009 U	0.0011 J	0.001 J	0.0004 J	0.0064	0.0029 J
Total HxCDD	0.00002 J	0.00016 J	0.00001 U	0.00018 J	0.00027 J	0.00007 J	0.00059 J	0.00046 J
Total HxCDF	0.00007 J	0.00022 J	0.00006 U	0.00023 J	0.00036 J	0.00004 J	0.0011 J	0.0008 J
Total PeCDD	0.00002 U	0.00002 U	0.00002 U	0.00007 J	0.00002 U	0.00002 U	0.00028 J	0.00028 J
Total PeCDF	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00012 J	0.00005 J
Total TCDD	0.0025 UJ	0.0024 UJ	0.0026 UJ	0.0024 UJ	0.0023 UJ	0.0027 UJ	0.0031 U	0.0025 UJ
Total TCDF	0.00007 J	0.00006 J	0.00006 J	0.00007 J	0.00007 J	0.00007 J	0.00006 J	0.00007 J
2,3,7,8-TCDD-TEQ	0.000021636	0.000030573	0.000016016	0.00002808	0.00003613	0.000020714	0.00008305	0.0000646

Notes:
 J - Detected, estimated.
 U - Nondetected.
 UJ - Nondetected, detection limit is estimated.
 R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

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Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T11-C1	CBS-CSB-T11-C1-D	CBS-CSB-T11-E1	CBS-CSB-T11-W1	CBS-CSB-T12-C1	CBS-CSB-T12-E1	CBS-CSB-T12-W1	CBS-CSB-T13-C1
Sample date	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01	11/19/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0298	0.117	0.0072	0.0159	0.00084 J	0.0101	0.012	0.0011 J
1,2,3,4,6,7,8,9-OCDF	0.0094	0.0587	0.002 J	0.0017 J	0.00048 J	0.0029 J	0.0018 J	0.0003 J
1,2,3,4,6,7,8-HpCDD	0.0027 J	0.0145	0.00064 J	0.0016 J	0.0003 J	0.00086 J	0.001 J	0.00008 J
1,2,3,4,6,7,8-HpCDF	0.0013 J	0.0079	0.0005 J	0.00044 J	0.00017 J	0.00064 J	0.00036 J	0.00004 J
1,2,3,4,7,8-HxCDD	0.00003 U	0.00042 J	0.00003 U	0.00003 U	0.00037 J	0.00003 U	0.0001 U	0.00001 U
1,2,3,4,7,8-HxCDF	0.00003 U	0.00002 U	0.00003 U	0.00003 U	0.00004 U	0.00004 J	0.00003 J	0.00001 U
1,2,3,4,7,8-HxCDD	0.00002 U	0.00015 J	0.00002 U	0.00002 U	0.00017 J	0.00002 U	0.000006 U	0.000007 U
1,2,3,6,7,8-HxCDD	0.00009 J	0.00034 J	0.00004 U	0.00006 J	0.00005 U	0.00003 U	0.00002 J	0.00001 U
1,2,3,6,7,8-HxCDF	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00004 U	0.00002 U	0.000006 U	0.000007 U
1,2,3,7,8,9-HxCDD	0.00003 U	0.00005 J	0.00003 U	0.00003 U	0.00015 J	0.00002 U	0.00003 J	0.00001 U
1,2,3,7,8,9-HxCDF	0.00002 U	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.000007 U	0.000008 U
1,2,3,7,8-PeCDD	0.00004 U	0.00003 U	0.00004 U	0.00004 U	0.00009 J	0.00003 U	0.00002 U	0.00002 U
1,2,3,7,8-PeCDF	0.00002 U	0.00002 U	0.00003 U	0.00003 U	0.00008 J	0.00002 U	0.00001 U	0.00001 U
2,3,4,6,7,8-HxCDF	0.00002 U	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.000007 U	0.000008 U
2,3,4,7,8-PeCDF	0.00003 U	0.00002 U	0.00003 U	0.00003 U	0.00014 J	0.00003 U	0.00001 U	0.00001 U
2,3,7,8-TCDD	0.00002 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.00001 U
2,3,7,8-TCDF	0.00002 U	0.00006 J	0.00002 U	0.00002 U	0.00018 J	0.00002 J	0.000008 U	0.000008 U
Total HpCDD	0.0048	0.0257	0.0013 J	0.003 J	0.00051 J	0.0018 J	0.0022 J	0.00018 J
Total HpCDF	0.005	0.0374	0.0015 J	0.0016 J	0.00054 J	0.002 J	0.0012 J	0.00016 J
Total HxCDD	0.00039 J	0.0027 J	0.00044 J	0.00057 J	0.0006 J	0.00069 J	0.00049 J	0.00001 U
Total HxCDF	0.00089 J	0.0052 J	0.00048 J	0.00072 J	0.0014 J	0.00057 J	0.00055 J	0.00007 U
Total PeCDD	0.00016 J	0.0016 J	0.00004 U	0.00017 J	0.00061 J	0.00022 J	0.00024 J	0.00002 U
Total PeCDF	0.00002 U	0.00018 J	0.00003 U	0.00003 U	0.00048 J	0.0002 J	0.00001 U	0.00001 U
Total TCDD	0.0033 UJ	0.0068 UJ	0.0024 UJ	0.0032 UJ	0.0036 UJ	0.0023 UJ	0.0027 UJ	0.0028 UJ
Total TCDF	0.00011 UJ	0.0002 UJ	0.00008 UJ	0.00008 UJ	0.0011 J	0.00007 UJ	0.00006 UJ	0.00009 UJ
2,3,7,8-TCDD-TEQ	0.00020842		0.00004972	0.00006356	0.000230532	0.00005095	0.00003713	0.00001714

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-5
Calculation of TCDD-TEQ
Saugat Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	B	B	B
Sample	CBS-CSB-T13-E1	CBS-CSB-T13-W1	CBS-CSB-T14-1	CBS-CSB-T15-1	CBS-CSB-T16-1	CBS-CSB-T17-C1	CBS-CSB-T17-E1	CBS-CSB-T17-E1D
Sample date	11/19/01	11/19/01	12/20/01	12/20/01	12/20/01	11/8/01	11/8/01	11/8/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0023 J	0.0034 J	0.0023 J	0.0107	0.298 J	0.00074 J	0.41	0.0832
1,2,3,4,6,7,8,9-OCDF	0.00036 J	0.00063 J	0.00036 U	0.0024 J	0.115	0.0001 J	0.238	0.0311
1,2,3,4,6,7,8-HxCDD	0.00013 J	0.0003 J	0.00023 J	0.0011 J	0.0282	0.00003 U	0.0392	0.0072
1,2,3,4,6,7,8-HpCDD	0.00009 J	0.00016 J	0.00009 J	0.00037 J	0.0155	0.00002 U	0.0215	0.0037
1,2,3,4,7,8,9-HpCDF	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.00095 J	0.00002 U	0.0005 U	0.0002 U
1,2,3,4,7,8-HxCDF	0.00001 U	0.00001 U	0.00003 U	0.00003 U	0.00002 U	0.00002 U	0.0003 U	0.0001 U
1,2,3,4,7,8-HxCDD	0.000008 U	0.00001 U	0.00001 U	0.00002 U	0.00041 J	0.00001 U	0.0002 U	0.00009 U
1,2,3,6,7,8-HxCDD	0.00001 U	0.00002 U	0.00003 U	0.00003 U	0.00099 J	0.00002 U	0.0116 J	0.0002 U
1,2,3,6,7,8-HxCDF	0.000007 U	0.000009 U	0.00002 U	0.00002 U	0.00013 J	0.00001 U	0.0003 U	0.0001 U
1,2,3,7,8,9-HxCDD	0.00001 U	0.00001 U	0.00003 U	0.00003 U	0.00017 J	0.00002 U	0.0004 U	0.0002 U
1,2,3,7,8,9-HxCDF	0.000009 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.0003 U	0.0001 U
1,2,3,7,8-PeCDD	0.00002 U	0.00002 U	0.00003 U	0.00004 U	0.00058 J	0.00002 U	0.0002 U	0.0001 U
1,2,3,7,8-PeCDF	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.0014 J	0.00001 U	0.0001 U	0.00008 U
2,3,4,6,7,8-HxCDF	0.000008 U	0.00001 U	0.00002 U	0.00002 U	0.00018 J	0.00001 U	0.0003 U	0.0001 U
2,3,4,7,8-PeCDF	0.00001 U	0.00002 U	0.00003 U	0.00003 U	0.00019 J	0.00002 U	0.0001 U	0.00008 U
2,3,7,8-TCDD	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.0001 U	0.00008 U
2,3,7,8-TCDF	0.000009 U	0.00001 U	0.00002 U	0.00002 U	0.00018 J	0.00001 U	0.00007 U	0.00005 U
Total HpCDD	0.00033 J	0.00057 J	0.00048 J	0.0022 J	0.0554	0.00003 U	0.0726	0.0141
Total HpCDF	0.00028 J	0.00051 J	0.00023 J	0.0014 J	0.0738 J	0.00002 U	0.09	0.0147
Total HxCDD	0.00012 J	0.00015 J	0.00003 U	0.00029 J	0.0101 J	0.00002 U	0.0195 J	0.0012 J
Total HxCDF	0.00005 J	0.00018 J	0.00004 J	0.00033 J	0.0188	0.00001 U	0.0193 J	0.0035 J
Total PeCDD	0.00002 U	0.00002 U	0.00003 U	0.00004 U	0.0023 J	0.00002 U	0.0044 J	0.0029 J
Total PeCDF	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.0038 J	0.00001 U	0.0001 U	0.00067 J
Total TCDD	0.0023 UJ	0.0026 UJ	0.0024 UJ	0.0025 UJ	0.0109 J	0.0032 UJ	0.0292	0.0043 UJ
Total TCDF	0.00006 UJ	0.00006 UJ	0.00006 UJ	0.00008 UJ	0.005 J	0.00006 UJ	0.00007 U	0.00005 U
2,3,7,8-TCDD-TEQ	0.000018366	0.000024553	0.000034548	0.00005291	0.0014398	0.000020684	0.001137885	

Notes:
 J - Detected, estimated.
 U - Nondetected.
 UJ - Nondetected, detection limit is estimated.
 R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	B	B	B	B	B	C	C	C
Sample	CBS-CSB-T17-W1	CBS-CSB-T18-C1	CBS-CSB-T18-E1	CBS-CSB-T18-W1	CBS-CSB-T18-W1D	CBS-CSC-T1-1	CBS-CSC-T2-1	CBS-CSC-T3-1
Sample date	11/9/01	11/9/01	11/9/01	11/9/01	11/9/01	12/13/01	12/13/01	12/13/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.00051 J	0.00046 J	0.0018 J	0.0019 J	0.0011 J	0.00074 J	0.0081	0.0006 J
1,2,3,4,6,7,8,9-OCDF	0.00001 U	0.00008 J	0.00034 J	0.0003 U	0.0003 U	0.00014 J	0.0027 J	0.00006 J
1,2,3,4,6,7,8-HxCDD	0.000008 U	0.00003 J	0.0001 UJ	0.0002 U	0.0001 U	0.00005 J	0.00055 J	0.00004 J
1,2,3,4,6,7,8-HpCDD	0.000005 U	0.00002 J	0.00009 U	0.0001 U	0.0001 U	0.00003 J	0.00038 J	0.00002 J
1,2,3,4,7,8,9-HpCDF	0.000006 U	0.00006 U	0.0001 U	0.0001 U	0.0001 U	0.00001 U	0.00001 U	0.00001 U
1,2,3,4,7,8-HxCDF	0.000005 U	0.00005 U	0.00007 U	0.00009 U	0.00007 U	0.00001 U	0.00001 U	0.000009 U
1,2,3,4,7,8-PeCDF	0.000004 U	0.00004 U	0.00005 U	0.00006 U	0.00006 U	0.00006 U	0.00001 J	0.000006 U
1,2,3,6,7,8-HxCDD	0.000006 U	0.00006 U	0.0001 U	0.0001 U	0.0001 U	0.00001 U	0.00002 J	0.00001 U
1,2,3,6,7,8-HxCDF	0.000004 U	0.00004 U	0.00006 U	0.00006 U	0.00006 U	0.000008 U	0.000008 U	0.000005 U
1,2,3,7,8,9-HxCDD	0.000005 U	0.00005 U	0.00009 U	0.0001 U	0.0001 U	0.00001 U	0.00001 U	0.00001 U
1,2,3,7,8,9-HxCDF	0.000004 U	0.00004 U	0.00006 U	0.00007 U	0.00007 U	0.000007 U	0.000007 U	0.000006 U
1,2,3,7,8-PeCDD	0.000009 U	0.00008 U	0.00006 U	0.00008 U	0.00007 U	0.00001 U	0.00002 U	0.00001 U
1,2,3,7,8-PeCDF	0.000006 U	0.00006 U	0.00004 U	0.00005 U	0.00004 U	0.00001 U	0.00001 U	0.00001 U
2,3,4,6,7,8-HxCDF	0.000004 U	0.00004 U	0.00006 U	0.00007 U	0.00006 U	0.000007 U	0.000007 U	0.000006 U
2,3,4,7,8-PeCDF	0.000008 U	0.00008 U	0.00004 UJ	0.00005 U	0.00004 U	0.00001 U	0.00001 U	0.00001 U
2,3,7,8-TCDD	0.000006 U	0.00005 U	0.00003 U	0.00004 U	0.00004 U	0.000008 U	0.00001 U	0.000008 U
2,3,7,8-TCDF	0.000005 U	0.00005 U	0.00002 U	0.00003 U	0.00003 U	0.000009 U	0.00001 U	0.000008 U
Total HpCDD	0.000008 U	0.00005 J	0.0001 U	0.0002 U	0.0001 U	0.00012 J	0.0012 J	0.0001 J
Total HpCDF	0.000005 U	0.00005 J	0.00009 U	0.0001 U	0.0001 U	0.0001 J	0.0012 J	0.00006 J
Total HxCDD	0.000005 U	0.00001 J	0.00007 U	0.00009 U	0.00007 U	0.00001 U	0.00029 J	0.000009 U
Total HxCDF	0.000004 U	0.00004 U	0.00005 U	0.00006 U	0.00006 U	0.00001 J	0.00015 J	0.000005 U
Total PeCDD	0.000009 U	0.00008 U	0.00006 U	0.00008 U	0.00007 U	0.00001 U	0.00015 J	0.00001 U
Total PeCDF	0.000006 U	0.00006 U	0.00004 U	0.00005 U	0.00004 U	0.00001 U	0.00001 U	0.00001 U
Total TCDD	0.0027 UJ	0.0027 UJ	0.003 UJ	0.0032 UJ	0.0034 UJ	0.0023 UJ	0.0025 UJ	0.0025 UJ
Total TCDF	0.00005 UJ	0.00004 UJ	0.00006 UJ	0.00003 U	0.00008 UJ	0.00007 UJ	0.00006 UJ	0.00006 UJ
2,3,7,8-TCDD-TEQ	0.0000084465	0.000008384	0.0000085164	0.00007654		0.000003338	0.00001488	0.000002968

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	C	C	C	C	C	C	C	D
Sample	CBS-CSC-T4-1	CBS-CSC-T4-1-FD	CBS-CSC-T5-1	CBS-CSC-T6-1	CBS-CSC-T7-1	CBS-CSC-T8-1	CBS-CSC-T9-1	CBS-CSD-T1-1
Sample date	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/13/01	12/12/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0235	0.0011 J	0.0012 J	0.0105	0.00089 J	0.0025 J	0.0031 J	0.0033 J
1,2,3,4,6,7,8,9-OCDF	0.0112	0.00041 J	0.0003 J	0.0025 J	0.00006 J	0.001 J	0.00054 J	0.00047 J
1,2,3,4,6,7,8-HxCDD	0.0023 J	0.0001 J	0.00009 J	0.00064 J	0.00002 U	0.00022 J	0.00018 J	0.00017 J
1,2,3,4,6,7,8-HxCDF	0.0023 J	0.00005 J	0.00006 J	0.00034 J	0.00002 J	0.00013 J	0.00008 J	0.0001 J
1,2,3,4,7,8-HxCDF	0.00005 J	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U
1,2,3,4,7,8-HxCDD	0.00001 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U
1,2,3,4,7,8-HxCDF	0.00003 J	0.00001 U	0.00001 U	0.00002 J	0.00001 U	0.00001 U	0.00007 U	0.0001 UJ
1,2,3,6,7,8-HxCDD	0.00006 J	0.00002 U	0.00002 U	0.00003 J	0.00002 U	0.00002 U	0.00001 U	0.00002 U
1,2,3,6,7,8-HxCDF	0.00001 J	0.00001 U	0.00008 U	0.00007 U	0.00001 U	0.00009 U	0.00006 U	0.00002 UJ
1,2,3,7,8,9-HxCDD	0.00003 J	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U
1,2,3,7,8,9-HxCDF	0.000007 U	0.00001 U	0.00001 U	0.00009 U	0.00001 U	0.00001 U	0.00008 U	0.00001 UJ
1,2,3,7,8-PeCDD	0.00002 U	0.00003 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U
1,2,3,7,8-PeCDF	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U
2,3,4,6,7,8-HxCDF	0.00002 J	0.00001 U	0.00001 U	0.00008 U	0.00001 U	0.00001 U	0.00008 U	0.00001 UJ
2,3,4,7,8-PeCDF	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00001 U	0.00002 U
2,3,7,8-TCDD	0.00001 U	0.00002 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U
2,3,7,8-TCDF	0.00002 J	0.00002 U	0.00001 U	0.00002 J	0.00001 U	0.00001 U	0.00001 U	0.00001 U
Total HpCDD	0.0044	0.00018 J	0.00022 J	0.0015 J	0.00002 U	0.00042 J	0.00046 J	0.00035 J
Total HpCDF	0.0081	0.00017 J	0.00018 J	0.0013 J	0.00005 J	0.00048 J	0.00028 J	0.00031 J
Total HxCDD	0.00068 J	0.00002 U	0.00002 U	0.00089 J	0.00002 U	0.00002 J	0.00004 J	0.00002 U
Total HxCDF	0.0104 J	0.00001 U	0.00002 J	0.00028 J	0.00001 U	0.00008 J	0.00004 J	0.00004 J
Total PeCDD	0.00039 J	0.00003 U	0.00002 U	0.00058 J	0.00002 U	0.00002 U	0.00002 U	0.00002 U
Total PeCDF	0.0027 J	0.00002 U	0.00002 U	0.00007 J	0.00002 U	0.00002 U	0.00001 U	0.00002 U
Total TCDD	0.0027 UJ	0.0027 UJ	0.0022 UJ	0.0029 UJ	0.0022 UJ	0.0025 UJ	0.0023 UJ	0.0024 UJ
Total TCDF	0.0002 J	0.00007 UJ	0.00006 UJ	0.00013 UJ	0.00007 UJ	0.00007 UJ	0.00006 UJ	0.00007 UJ
2,3,7,8-TCDD-TEQ	0.0000366105		0.0000058	0.0000199	0.000004477	0.0000079	0.000005564	0.000014677

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	D	D	D	D	D	E	E	E
Sample	CBS-CSD-T2-1	CBS-CSD-T3-1	CBS-CSD-T4-1	CBS-CSD-T5-1	CBS-CSD-T6-1	CBS-CSE-T1-1	CBS-CSE-T2-1	CBS-CSE-T3-1
Sample date	12/12/01	12/12/01	12/12/01	12/12/01	12/12/01	12/18/01	12/18/01	12/18/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0136	0.0014 J	0.0011 J	0.0037 J	0.312 J	0.00074 J	0.0035 J	0.0014 J
1,2,3,4,6,7,8,9-OCDF	0.0069	0.00031 J	0.00044 J	0.0016 J	0.174 J	0.00017 J	0.00098 J	0.00065 J
1,2,3,4,6,7,8-HxCDD	0.0012 J	0.00009 J	0.0001 J	0.00029 J	0.0277	0.00007 J	0.00031 J	0.00016 J
1,2,3,4,6,7,8-HxCDF	0.0013 J	0.00002 U	0.00009 J	0.00026 J	0.0226	0.00002 U	0.0002 J	0.00009 J
1,2,3,4,7,8,9-HpCDD	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.0011 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,4,7,8-HxCDD	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.0001 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,4,7,8-HxCDF	0.00001 UJ	0.00002 UJ	0.00001 UJ	0.00001 UJ	0.00048 J	0.00002 U	0.00001 U	0.00001 U
1,2,3,6,7,8-HxCDD	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00099 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,6,7,8-HxCDF	0.00001 UJ	0.00002 UJ	0.00002 UJ	0.00001 UJ	0.00012 J	0.00002 U	0.00002 U	0.00001 U
1,2,3,7,8,9-HxCDD	0.00006 J	0.00002 U	0.00002 U	0.00002 U	0.00029 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,7,8,9-HxCDF	0.00002 UJ	0.00002 UJ	0.00002 UJ	0.00001 UJ	0.0001 J	0.00002 U	0.00002 U	0.00001 U
1,2,3,7,8-PeCDD	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U	0.00003 U	0.00002 U
1,2,3,7,8-PeCDF	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00038 J	0.00002 U	0.00002 U	0.00002 U
2,3,4,6,7,8-HxCDF	0.00002 UJ	0.00002 UJ	0.00002 UJ	0.00001 UJ	0.00031 J	0.00002 U	0.00002 U	0.00001 U
2,3,4,7,8-PeCDF	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.00009 J	0.00002 U	0.00002 U	0.00002 U
2,3,7,8-TCDD	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00001 U
2,3,7,8-TCDF	0.00001 U	0.00001 U	0.00001 U	0.00001 U	0.0002 J	0.00001 U	0.00001 U	0.00001 U
Total HpCDD	0.0021 J	0.00021 J	0.00019 J	0.00059 J	0.0528	0.00015 J	0.00067 J	0.0003 J
Total HpCDF	0.004 J	0.0001 J	0.00027 J	0.00068 J	0.085	0.00008 J	0.00056 J	0.00033 J
Total HxCDD	0.00051 J	0.00002 U	0.00002 U	0.00002 U	0.0062	0.00002 U	0.00007 J	0.00002 U
Total HxCDF	0.00059 J	0.00002 U	0.00001 U	0.00008 J	0.0156 J	0.00002 U	0.0001 J	0.00003 J
Total PeCDD	0.00001 J	0.00002 U	0.00002 U	0.00002 U	0.0016 J	0.00003 U	0.00003 U	0.00002 U
Total PeCDF	0.00002 U	0.00002 U	0.00002 U	0.00002 U	0.0025 J	0.00002 U	0.00002 U	0.00002 U
Total TCDD	0.0026 UJ	0.0027 UJ	0.0029 UJ	0.0028 UJ	0.0105 J	0.0023 UJ	0.0025 UJ	0.0026 UJ
Total TCDF	0.00006 UJ	0.00007 UJ	0.00007 UJ	0.00007 UJ	0.0021 J	0.00007 UJ	0.00008 UJ	0.00007 UJ
2,3,7,8-TCDD-TEQ	0.00004435	0.000014271	0.000014854	0.00001713	0.0008858	0.000020491	0.000024648	0.000020495

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-5
Calculation of TCDD-TEQ
Saugat Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	E	E	E	E	E	E	E	E
Sample	CBS-CSE-T3-1-FD	CBS-CSE-T4-1	CBS-CSE-T5-1	CBS-CSE-T6-1	CBS-CSE-T7-1	CBS-CSE-T8-1	CBS-CSE-T8-1	CBS-CSE-T10-1
Sample date	12/18/01	12/18/01	12/18/01	12/18/01	12/19/01	12/19/01	12/19/01	12/19/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0018 J	0.001 J	0.00051 J	0.0028 J	0.0052 J	0.0031 J	0.00032 U	0.00019 U
1,2,3,4,6,7,8,9-OCDF	0.00064 J	0.00011 J	0.00013 J	0.0014 J	0.0013 J	0.0013 J	0.00005 U	0.00008 U
1,2,3,4,6,7,8-HxCDD	0.00014 J	0.00008 J	0.00005 U	0.00026 J	0.00043 J	0.00023 J	0.00003 U	0.00006 U
1,2,3,4,6,7,8-HxCDF	0.00014 J	0.00003 U	0.00005 U	0.00019 J	0.00019 J	0.00016 J	0.00002 U	0.00004 U
1,2,3,4,7,8,9-HxCDD	0.00003 U	0.00003 U	0.00005 U	0.00006 U	0.00003 U	0.00002 U	0.00003 U	0.00004 U
1,2,3,4,7,8-HxCDF	0.00002 U	0.00003 U	0.00004 U	0.00007 U	0.00002 U	0.00001 U	0.00002 U	0.00002 U
1,2,3,4,7,8-HxCDD	0.00002 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00001 U	0.00002 U	0.00002 U
1,2,3,6,7,8-HxCDD	0.00003 U	0.00004 U	0.00004 U	0.00001 J	0.00003 U	0.00002 U	0.00003 U	0.00004 U
1,2,3,6,7,8-HxCDF	0.00002 U	0.00003 U	0.00004 U	0.00004 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U
1,2,3,7,8,9-HxCDD	0.00003 U	0.00003 U	0.00004 U	0.00007 U	0.00003 U	0.00002 U	0.00003 U	0.00005 U
1,2,3,7,8,9-HxCDF	0.00002 U	0.00003 U	0.00004 U	0.00005 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U
1,2,3,7,8-PeCDD	0.00003 U	0.00004 U	0.00005 U	0.00001 U	0.00003 U	0.00003 U	0.00003 U	0.00005 U
1,2,3,7,8-PeCDF	0.00003 U	0.00003 U	0.00004 U	0.00007 U	0.00002 U	0.00002 U	0.00002 U	0.00004 U
2,3,4,6,7,8-HxCDF	0.00002 U	0.00003 U	0.00003 U	0.00006 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U
2,3,4,7,8-PeCDF	0.00003 U	0.00003 U	0.00004 U	0.00007 U	0.00003 U	0.00003 U	0.00003 U	0.00004 U
2,3,7,8-TCDD	0.00002 U	0.00002 U	0.00003 U	0.00007 U	0.00002 U	0.00002 U	0.00002 U	0.00003 U
2,3,7,8-TCDF	0.00002 U	0.00002 U	0.00003 U	0.00006 U	0.00002 U	0.00002 U	0.00002 U	0.00002 U
Total HpCDD	0.00032 J	0.00014 J	0.00005 U	0.00048 J	0.00095 J	0.00048 J	0.00003 U	0.00006 U
Total HpCDF	0.00042 J	0.00003 U	0.00005 U	0.00072 J	0.00072 J	0.00067 J	0.00002 U	0.00004 U
Total HxCDD	0.00002 U	0.00003 U	0.00004 U	0.00006 J	0.00009 J	0.00002 U	0.00002 U	0.00004 U
Total HxCDF	0.00002 U	0.00002 U	0.00003 U	0.00011 J	0.00016 J	0.00014 J	0.00002 U	0.00002 U
Total PeCDD	0.00003 U	0.00004 U	0.00005 U	0.00001 U	0.00003 U	0.00003 U	0.00003 U	0.00005 U
Total PeCDF	0.00003 U	0.00003 U	0.00004 U	0.000007 U	0.00002 U	0.00002 U	0.00002 U	0.00004 U
Total TCDD	0.0025 UJ	0.0024 UJ	0.0023 UJ	0.0025 UJ	0.0025 UJ	0.0028 UJ	0.0027 UJ	0.0024 UJ
Total TCDF	0.00008 UJ	0.0001 UJ	0.00011 UJ	0.00008 UJ	0.00008 UJ	0.00008 UJ	0.00008 UJ	0.00008 UJ
2,3,7,8-TCDD-TEQ	0.000028011	0.000034814	0.000012	0.000028	0.00002394	0.0000214185 U	0.0000337135 U	

Notes:
 J - Detected, estimated.
 U - Nondetected.
 UJ - Nondetected, detection limit is estimated.
 R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

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Creek segment	E	E	E	E	E	E	E	E
Sample	CBS-CSE-T11-1	CBS-CSE-T12-1	CBS-CSE-T13-2	CBS-CSE-T14-1	CBS-CSE-T15-1	CBS-CSE-T15-1-FD	CBS-CSE-T16-1	CBS-CSE-T17-1
Sample date	12/18/01	12/19/01	2/14/02	12/18/01	12/18/01	12/18/01	12/21/01	12/21/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0023 J	0.00028 U	0.0038 J	0.0026 J	0.00062 J	0.0006 J	0.037	0.0474
1,2,3,4,6,7,8,9-OCDF	0.00099 J	0.00008 U	0.0015 J	0.0011 J	0.00009 J	0.00012 J	0.0166	0.0149
1,2,3,4,6,7,8-HxCDD	0.00023 J	0.00004 U	0.0003 J	0.00024 J	0.00005 J	0.00004 J	0.0029 J	0.0048
1,2,3,4,6,7,8-HxCDF	0.00015 J	0.00003 U	0.00022 J	0.00019 J	0.00002 J	0.00003 J	0.0017 J	0.0021 J
1,2,3,4,7,8,9-HxCDF	0.00003 U	0.00003 U	0.00007 U	0.00007 U	0.00006 U	0.00005 U	0.0001 J	0.0001 J
1,2,3,4,7,8-HxCDD	0.00003 U	0.00003 U	0.00007 U	0.00007 U	0.00007 U	0.00006 U	0.00002 U	0.00001 U
1,2,3,4,7,8-HxCDF	0.00002 U	0.00002 U	0.00005 U	0.00005 U	0.00004 U	0.00004 U	0.00005 J	0.00005 J
1,2,3,6,7,8-HxCDD	0.00003 U	0.00003 U	0.00001 J	0.00001 J	0.00006 U	0.00006 U	0.00009 J	0.00012 J
1,2,3,6,7,8-HxCDF	0.00002 U	0.00002 U	0.00004 U	0.00005 U	0.00004 U	0.00003 U	0.00003 J	0.00004 J
1,2,3,7,8,9-HxCDD	0.00003 U	0.00003 U	0.00007 U	0.00008 U	0.00007 U	0.00006 U	0.00002 U	0.00011 J
1,2,3,7,8,9-HxCDF	0.00002 U	0.00002 U	0.00005 U	0.00005 U	0.00004 U	0.00004 U	0.00001 U	0.00001 U
1,2,3,7,8-PeCDD	0.00004 U	0.00003 U	0.00001 U	0.00001 U	0.00001 U	0.00008 U	0.00002 U	0.00004 J
1,2,3,7,8-PeCDF	0.00003 U	0.00003 U	0.00008 U	0.00008 U	0.00007 U	0.00007 U	0.00002 U	0.00001 U
2,3,4,6,7,8-HxCDF	0.00002 U	0.00002 U	0.00005 U	0.00005 U	0.00004 U	0.00004 U	0.00001 U	0.00001 U
2,3,4,7,8-PeCDF	0.00003 U	0.00003 U	0.00008 U	0.00008 U	0.00008 U	0.00007 U	0.00002 U	0.00001 U
2,3,7,8-TCDD	0.00002 U	0.00002 U	0.00008 U	0.00007 U	0.00007 U	0.00006 U	0.00002 U	0.00001 U
2,3,7,8-TCDF	0.00002 U	0.00002 U	0.00007 U	0.00007 U	0.00007 U	0.00006 U	0.00004 J	0.00005 J
Total HpCDD	0.00046 J	0.00004 U	0.00059 J	0.00046 J	0.0001 J	0.00009 J	0.0058	0.0086
Total HpCDF	0.00055 J	0.00003 U	0.00083 J	0.00061 J	0.00005 J	0.00007 J	0.0078	0.0083
Total HxCDD	0.00003 U	0.00003 U	0.00009 J	0.00005 J	0.00008 U	0.00006 U	0.0018 J	0.0012 J
Total HxCDF	0.00005 J	0.00002 U	0.00012 J	0.00009 J	0.00004 U	0.00009 J	0.00091 J	0.0022 J
Total PeCDD	0.00004 U	0.00003 U	0.00003 J	0.00001 U	0.00001 U	0.00008 U	0.0015 J	0.0007 J
Total PeCDF	0.00003 U	0.00003 U	0.00008 U	0.00008 U	0.00008 U	0.00007 U	0.00091 J	0.0013 J
Total TCDD	0.0028 UJ	0.0028 UJ	0.0025 UJ	0.0022 UJ	0.002 UJ	0.002 UJ	0.003 UJ	0.0027 UJ
Total TCDF	0.00007 UJ	0.00007 UJ	0.00008 UJ	0.00008 UJ	0.00005 UJ	0.00005 UJ	0.0013 J	0.0016 J
2,3,7,8-TCDD-TEQ	0.000030279	0.000021516 U	0.000012915	0.000011955	0.000006624		0.00008436	0.00010523

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	F	F	F	F	F	F	F	F
Sample	CBS-CSF-T1-1	CBS-CSF-T2-1	CBS-CSF-T3-1	CBS-CSF-T4-1	CBS-CSF-T5-1	CBS-CSF-T6-1	CBS-CSF-T6-1-FD	CBS-CSF-T7-1
Sample date	12/21/01	12/11/01	12/11/01	12/11/01	1/8/02	1/16/02	1/16/02	1/16/02
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.0011 J	0.00058 J	0.0074	0.00084 J	0.0059 J	0.0017 J	0.0011 J	0.00066 J
1,2,3,4,6,7,8,9-OCDF	0.00038 U	0.00013 J	0.0025 J	0.00003 U	0.0031 J	0.00018 J	0.00023 J	0.00014 J
1,2,3,4,6,7,8-HxCDD	0.0001 J	0.00001 U	0.00061 J	0.00002 U	0.0015 J	0.00009 J	0.00006 J	0.00008 J
1,2,3,4,6,7,8-HpCDF	0.00005 J	0.00001 U	0.00037 J	0.00002 U	0.00064 J	0.00003 U	0.00003 U	0.00002 U
1,2,3,4,7,8,9-HpCDF	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00027 J	0.00003 U	0.00003 U	0.00002 U
1,2,3,4,7,8-HxCDD	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00018 J	0.00003 U	0.00003 U	0.00002 U
1,2,3,4,7,8-HxCDF	0.000009 U	0.00001 UJ	0.00001 UJ	0.00002 UJ	0.00064 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,6,7,8-HxCDD	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00041 J	0.00003 U	0.00003 U	0.00003 U
1,2,3,6,7,8-HxCDF	0.000008 U	0.00001 UJ	0.00001 UJ	0.00002 UJ	0.00026 U	0.00002 U	0.00002 U	0.00002 U
1,2,3,7,8,9-HxCDD	0.00001 U	0.00001 U	0.00001 U	0.00002 U	0.00055 J	0.00003 U	0.00003 U	0.00003 U
1,2,3,7,8,9-HxCDF	0.00001 U	0.00001 UJ	0.00001 UJ	0.00002 UJ	0.00038 J	0.00002 U	0.00002 U	0.00002 U
1,2,3,7,8-PeCDD	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00025 J	0.00004 U	0.00003 U	0.00003 U
1,2,3,7,8-PeCDF	0.000002 U	0.00001 U	0.00001 U	0.00002 U	0.0003 J	0.00003 U	0.00003 U	0.00003 U
2,3,4,6,7,8-HxCDF	0.00001 U	0.00001 UJ	0.00001 UJ	0.00002 UJ	0.00026 J	0.00002 U	0.00002 U	0.00002 U
2,3,4,7,8-PeCDF	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00035 J	0.00003 U	0.00003 U	0.00003 U
2,3,7,8-TCDD	0.00001 U	0.000009 U	0.000008 U	0.00001 U	0.00006 U	0.00002 U	0.00002 U	0.00002 U
2,3,7,8-TCDF	0.00001 U	0.000007 U	0.000007 U	0.00001 U	0.00075 J	0.00002 U	0.00002 U	0.00002 U
Total HpCDD	0.00021 J	0.00001 U	0.0012 J	0.00002 U	0.0028 J	0.00017 J	0.00006 J	0.00008 J
Total HpCDF	0.0002 J	0.00005 J	0.0014 J	0.00002 U	0.0024 J	0.00003 U	0.00005 J	0.00007 J
Total HxCDD	0.00002 J	0.00001 U	0.00007 J	0.00002 U	0.0042 J	0.00003 U	0.00003 U	0.00002 U
Total HxCDF	0.00004 J	0.00001 U	0.00029 J	0.00002 U	0.007 J	0.00002 U	0.00002 U	0.00002 U
Total PeCDD	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.0036 J	0.00004 U	0.00003 U	0.00003 U
Total PeCDF	0.00002 U	0.00001 U	0.00008 J	0.00002 U	0.0029 J	0.00003 U	0.00003 U	0.00003 U
Total TCDD	0.0022 UJ	0.0027 UJ	0.0028 UJ	0.0026 UJ	0.0307 J	0.0026 UJ	0.0028 UJ	0.0024 UJ
Total TCDF	0.00007 UJ	0.00006 UJ	0.00023 J	0.00007 UJ	0.0042 J	0.00007 UJ	0.00007 UJ	0.00007 UJ
2,3,7,8-TCDD-TEQ	0.000020629	0.000011321	0.00002194	0.0000223855	0.000769	0.0000354605		0.00003233

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

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Creek segment	F	F	F	F	F	F	F	F
Sample	CBS-CSF-T9-1	CBS-CSF-T9-1	CBS-CSF-T9-1-FD	CBS-CSF-T10-1	CBS-CSF-T11-1	CBS-CSF-T12-1	CBS-CSF-T13-1	CBS-CSF-T14-1
Sample date	1/23/02	1/23/02	1/23/02	1/25/02	1/25/02	1/23/02	1/16/02	1/8/02
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.00031 J	0.00089 J	0.00083 J	0.00037 J	0.0011 J	0.00087 J	0.00014 J	0.0092
1,2,3,4,6,7,8,9-OCDF	0.00009 UJ	0.00028 J	0.00031 U	0.0001 J	0.00015 J	0.00019 U	0.0004 U	0.0076
1,2,3,4,6,7,8-HxCDD	0.00005 U	0.00007 J	0.00008 J	0.00006 J	0.00008 J	0.00011 J	0.00003 U	0.0011 J
1,2,3,4,6,7,8-HxCDF	0.00004 U	0.00004 J	0.00005 J	0.00002 U	0.00003 U	0.00006 J	0.00002 U	0.00093 J
1,2,3,4,7,8,9-HxCDF	0.00004 U	0.00008 U	0.00009 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.0001 J
1,2,3,4,7,8-HxCDD	0.00004 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00005 J
1,2,3,4,7,8-HxCDF	0.00003 U	0.00006 U	0.00006 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00017 UJ
1,2,3,6,7,8-HxCDD	0.00005 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00014 J
1,2,3,6,7,8-HxCDF	0.00003 U	0.00006 U	0.00006 U	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.00008 UJ
1,2,3,7,8,9-HxCDD	0.00005 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00014 J
1,2,3,7,8,9-HxCDF	0.00003 U	0.00006 U	0.00006 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 UJ
1,2,3,7,8-PeCDD	0.00005 U	0.00001 U	0.00001 U	0.00003 U	0.00004 U	0.00005 U	0.00003 U	0.00008 J
1,2,3,7,8-PeCDF	0.00004 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00008 J
2,3,4,6,7,8-HxCDF	0.00003 U	0.00008 U	0.00008 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00002 UJ
2,3,4,7,8-PeCDF	0.00004 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.0001 J
2,3,7,8-TCDD	0.00003 U	0.00001 U	0.00001 U	0.00002 U	0.00002 U	0.00003 U	0.00002 U	0.00001 U
2,3,7,8-TCDF	0.00003 U	0.00001 U	0.00009 U	0.00001 U	0.00002 U	0.00003 U	0.00002 U	0.00017 J
Total HpCDD	0.00005 U	0.00015 J	0.00018 J	0.00013 J	0.00016 J	0.00011 J	0.00003 U	0.002 J
Total HpCDF	0.00004 U	0.00014 J	0.00018 J	0.00005 J	0.00007 J	0.00014 J	0.00002 U	0.0036
Total HxCDD	0.00004 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.0011 J
Total HxCDF	0.00003 U	0.00001 J	0.00002 J	0.00001 U	0.00002 U	0.00002 U	0.00002 U	0.0017 J
Total PeCDD	0.00005 U	0.00001 U	0.00001 U	0.00003 U	0.00004 U	0.00005 U	0.00003 U	0.00063 J
Total PeCDF	0.00004 U	0.00001 U	0.00001 U	0.00002 U	0.00003 U	0.00004 U	0.00002 U	0.00061 J
Total TCDD	0.0025 UJ	0.0022 UJ	0.0022 UJ	0.0025 UJ	0.0027 UJ	0.0024 UJ	0.0022 UJ	0.0027 UJ
Total TCDF	0.00009 UJ	0.00006 UJ	0.00006 UJ	0.00007 UJ	0.00008 UJ	0.00008 UJ	0.00007 UJ	0.0011 J
2,3,7,8-TCDD-TEQ	0.0000496855	0.00001196525		0.000027347	0.000037975	0.0000494965	0.000027886	0.00021748

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	F	F	F	SITE M	SITE M	SITE M	SITE M	SITE M
Sample	CBS-CSF-T15-1	CBS-CSF-T15-1-FD	CBS-CSF-T16-1	SED-M-S2 0-6	SED-M-S3-(0-6)	SED-M-S4-(0-6)	SED-M-S5 0-6	SED-M-S6-(0-6)
Sample date	1/8/02	1/8/02	2/6/02	6/22/01	7/10/01	8/1/01	6/22/01	7/10/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:								
1,2,3,4,6,7,8,9-OCDD	0.008	0.0067	0.0022 J	0.0347	0.135	0.339 J	0.11	0.0407 J
1,2,3,4,6,7,8,9-OCDF	0.0046 J	0.0043 J	0.00007 U	0.0134	0.032	0.153 J	0.0533	0.005 J
1,2,3,4,6,7,8-HxCDD	0.00063 J	0.00065 J	0.00005 U	0.0043	0.0102	0.0278	0.0142	0.004 J
1,2,3,4,6,7,8-HxCDF	0.00061 J	0.00068 J	0.00004 U	0.0023 J	0.0038	0.0153	0.0116	0.00085 J
1,2,3,4,7,8-HxCDF	0.00002 UJ	0.00003 UJ	0.00004 U	0.00011 J	0.00004 U	0.00088 J	0.00054 J	0.00005 U
1,2,3,4,7,8-HxCDD	0.00002 U	0.00002 U	0.00004 U	0.00002 U	0.00003 U	0.00004 U	0.00003 U	0.00004 U
1,2,3,4,7,8-HxCDF	0.00005 U	0.00008 U	0.00002 U	0.000009 U	0.00013 J	0.00003 U	0.00038 J	0.00003 U
1,2,3,6,7,8-HxCDD	0.00005 J	0.00004 J	0.00004 U	0.00014 J	0.00028 J	0.00091 J	0.00059 J	0.00015 J
1,2,3,6,7,8-HxCDF	0.00002 U	0.00002 U	0.00002 U	0.000009 U	0.00002 U	0.00003 U	0.00015 J	0.00003 U
1,2,3,7,8-HxCDD	0.00006 J	0.00006 J	0.00004 U	0.00009 J	0.00003 U	0.00029 J	0.00023 J	0.00004 U
1,2,3,7,8-HxCDF	0.00002 UJ	0.00002 UJ	0.00003 U	0.00001 U	0.00003 U	0.00004 U	0.00002 U	0.00003 U
1,2,3,7,8-PeCDD	0.00002 U	0.00002 U	0.00004 U	0.00002 U	0.00004 U	0.00006 U	0.00003 U	0.00006 U
1,2,3,7,8-PeCDF	0.00002 U	0.00002 U	0.00003 U	0.00001 U	0.00001 U	0.00002 U	0.00001 U	0.00002 U
2,3,4,6,7,8-HxCDF	0.00002 UJ	0.00002 UJ	0.00003 U	0.00001 U	0.00003 U	0.00003 U	0.00014 J	0.00003 U
2,3,4,7,8-PeCDF	0.00002 U	0.00002 U	0.00003 U	0.00001 U	0.00002 U	0.00003 U	0.00006 J	0.00003 U
2,3,7,8-TCDD	0.00001 U	0.00001 U	0.00002 U	0.00001 U	0.00002 U	0.00003 U	0.00002 U	0.00003 U
2,3,7,8-TCDF	0.00005 J	0.00004 J	0.00002 U	0.00001 U	0.00001 U	0.00002 U	0.00008 J	0.00002 U
Total HpCDD	0.0012 J	0.0012 J	0.00005 U	0.0079	0.0283	0.0538	0.027	0.0069
Total HpCDF	0.0017 J	0.0023 J	0.00004 U	0.0091	0.0149	0.0683 J	0.0421	0.0034
Total HxCDD	0.00039 J	0.00035 J	0.00004 U	0.0013 J	0.0082 J	0.0078 J	0.0161 J	0.0013 J
Total HxCDF	0.00041 UJ	0.00058 UJ	0.00002 U	0.0013 J	0.0019 J	0.009 J	0.0117 J	0.00075 J
Total PeCDD	0.00004 J	0.00004 J	0.00004 U	0.00052 J	0.0024 J	0.0022 J	0.0137 J	0.00014 J
Total PeCDF	0.00008 J	0.00002 U	0.00003 U	0.00013 J	0.00007 J	0.00049 J	0.0023 J	0.00007 J
Total TCDD	0.0026 UJ	0.0024 UJ	0.0024 UJ	0.0035 UJ	0.0034 UJ	0.0051 UJ	0.0038 UJ	0.0033 UJ
Total TCDF	0.00022 UJ	0.0001 UJ	0.00005 UJ	0.00016 UJ	0.00003 J	0.00002 U	0.0025 J	0.00002 U
2,3,7,8-TCDD-TEQ	0.000050905		0.0000401235	0.00009956	0.00020765	0.0006225	0.00046698	0.00008382

Notes:
J - Detected, estimated.
U - Nondetected.
UJ - Nondetected, detection limit is estimated.
R - Rejected.

(a) - Calculated in accordance with the steps outlined in Section 3.1.3 and 4.5 of the human health risk assessment. Note that totals are not presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Table A-3
Calculation of TCDD-TEQ
Sauget Area 1-Creek Bottom Soils
Human Health Risk Assessment

Creek segment	SITE M SED-M-S7-(0-6)	SITE M SED-M-S7-FD(0-6)	SITE M SED-M-S8 0-6	SITE M SED-M-S9-(0-6)	SITE M SED-M-S10 0-6
Sample	8/1/01	8/1/01	8/22/01	7/10/01	8/22/01
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte:					
1,2,3,4,6,7,8,9-OCDD	0.44 J	0.455 J	0.172	0.142	1.36
1,2,3,4,6,7,8,9-OCDF	0.12	0.129 J	0.139	0.0677	0.88
1,2,3,4,6,7,8-HxCDD	0.0399	0.0413	0.0243	0.0211	0.25
1,2,3,4,6,7,8-HxCDF	0.0141	0.0148	0.017	0.0085	0.0886
1,2,3,4,7,8,9-HxCDF	0.0012 J	0.0011 J	0.0011 J	0.00055 J	0.0072
1,2,3,4,7,8-HxCDD	0.00009 U	0.00009 U	0.00004 U	0.00003 U	0.0002 U
1,2,3,4,7,8-HxCDF	0.00006 U	0.00006 U	0.00047 J	0.00022 J	0.0043
1,2,3,6,7,8-HxCDD	0.0014 J	0.0014 J	0.00094 J	0.00058 J	0.0059
1,2,3,6,7,8-HxCDF	0.00006 U	0.00006 U	0.00002 U	0.00002 U	0.00079 J
1,2,3,7,8,9-HxCDD	0.00089 J	0.00081 J	0.00004 U	0.00013 J	0.00084 J
1,2,3,7,8,9-HxCDF	0.00007 U	0.00007 U	0.00003 U	0.00003 U	0.0002 U
1,2,3,7,8-PeCDD	0.0001 U	0.0001 U	0.00003 U	0.00004 U	0.0002 U
1,2,3,7,8-PeCDF	0.00004 U	0.00004 U	0.00001 U	0.00002 U	0.00062 J
2,3,4,6,7,8-HxCDF	0.00006 U	0.00006 U	0.00019 J	0.00003 U	0.00059 J
2,3,4,7,8-PeCDF	0.00005 U	0.00005 U	0.00002 U	0.00002 U	0.00038 J
2,3,7,8-TCDD	0.00006 U	0.00006 U	0.00002 U	0.00002 U	0.00008 U
2,3,7,8-TCDF	0.00004 U	0.00004 U	0.00009 J	0.00002 U	0.00009 J
Total HpCDD	0.0728	0.0783	0.0434	0.0422	0.447
Total HpCDF	0.0663 J	0.0695	0.0736	0.042	0.59
Total HxCDD	0.0101 J	0.0111 J	0.0157 J	0.0075	0.0439 J
Total HxCDF	0.0111	0.0104 J	0.0132	0.0059 J	0.0653 J
Total PeCDD	0.0019 J	0.0014 J	0.0087 J	0.0014 J	0.0348 J
Total PeCDF	0.00038 J	0.00038 J	0.0014 J	0.00036 J	0.0072 J
Total TCDD	0.0077 UJ	0.006 UJ	0.0038 UJ	0.0074 UJ	0.0862 J
Total TCDF	0.0023	0.0032 J	0.0021 J	0.00029 J	0.0087 J
2,3,7,8-TCDD-TEQ	0.0008615	0.0006759	0.00063235	0.00042247	0.005225

Notes:

J - Detected, estimated.

U - Nondetected.

UJ - Nondetected, detection

limit is estimated.

R - Rejected.

(a) - Calculated in accordance with the steps outlined in

Section 3.1.3 and 4.5 of the human health risk assessment.

Note that totals are not

presented for duplicates; the total for the parent sample is the average total of the sample and the duplicate.

Attachment B

Background Calculations

ATTACHMENT B

SUMMARY STATISTICS AND CALCULATION OF BACKGROUND CONCENTRATIONS - CREEK BOTTOM SOILS
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Constituent	Units	Frequency of Detection			Summary Statistics			Calculated Background Concentration (a)
		Total # Samples (b)	# Detects	% Detected	Minimum	Average	Maximum	
2,4-D	ug/kg	4	1	25%	8.50E+00	1.01E+01	1.20E+01	2.03E+01
2-Butanone (MEK)	ug/kg	4	3	75%	1.40E+01	2.49E+01	4.00E+01	4.99E+01
Acetone	ug/kg	4	3	75%	4.75E+01	7.78E+01	1.60E+02	1.56E+02
Aluminum	mg/kg	4	4	100%	1.20E+04	1.45E+04	1.90E+04	2.90E+04
Antimony	mg/kg	3	2	67%	1.30E+00	1.38E+00	1.45E+00	2.75E+00
Arsenic	mg/kg	4	4	100%	6.70E+00	7.18E+00	8.00E+00	1.44E+01
Barium	mg/kg	4	4	100%	1.65E+02	2.06E+02	2.30E+02	4.13E+02
Beryllium	mg/kg	4	4	100%	6.20E-01	7.80E-01	1.00E+00	1.56E+00
Cadmium	mg/kg	4	4	100%	2.90E-01	4.15E-01	6.50E-01	8.30E-01
Calcium	mg/kg	4	4	100%	1.20E+04	1.35E+04	1.80E+04	2.70E+04
Chromium	mg/kg	4	4	100%	1.70E+01	2.00E+01	2.50E+01	4.00E+01
Cobalt	mg/kg	4	4	100%	7.10E+00	8.60E+00	1.00E+01	1.72E+01
Copper	mg/kg	4	4	100%	1.60E+01	1.90E+01	2.30E+01	3.80E+01
Iron	mg/kg	4	4	100%	1.75E+04	2.06E+04	2.40E+04	4.13E+04
Lead	mg/kg	4	4	100%	1.65E+01	2.19E+01	2.60E+01	4.38E+01
Magnesium	mg/kg	4	4	100%	3.25E+03	5.14E+03	6.50E+03	1.03E+04
Manganese	mg/kg	4	4	100%	5.70E+02	7.08E+02	7.70E+02	1.42E+03
Mercury	mg/kg	4	4	100%	4.00E-02	4.80E-02	6.30E-02	9.60E-02
Molybdenum	mg/kg	4	4	100%	3.70E-01	4.45E-01	5.30E-01	8.90E-01
Nickel	mg/kg	4	4	100%	1.75E+01	2.14E+01	2.60E+01	4.28E+01
Pentachlorophenol	ug/kg	4	1	25%	3.76E+02	3.76E+02	3.76E+02	7.52E+02
Potassium	mg/kg	4	4	100%	1.60E+03	2.10E+03	2.60E+03	4.20E+03
Total 2,3,7,8-TCDD-TEQ	ug/kg	4	4	100%	5.38E-03	6.22E-03	7.60E-03	1.24E-02
Total Organic Carbon	mg/kg	4	4	100%	1.20E+04	1.70E+04	2.30E+04	3.40E+04
Vanadium	mg/kg	4	4	100%	2.95E+01	3.49E+01	4.40E+01	6.98E+01
Zinc	mg/kg	4	4	100%	5.90E+01	8.30E+01	9.60E+01	1.66E+02

Notes:

(a) - Background as defined in the Human Health Risk Assessment Workplan for Sauget Area 1 is two times the average concentration in the background or reference samples (USEPA, Region 4, 2000.)

(b) - Samples SED-RA1-S1-0.2FT, SED-RA1-S2-0.2FT, SED-RA2-S1-0.2FT and SED-RA2-S2-0.2FT.

Attachment C

Screening Values

Table C-1
 Residential Soil Direct-Contact Screening Values
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

CAS Number	Constituent	Exposure Route-Specific Values for Soils (a)			
		Units	Ingestion	Inhalation	Selected (Lowest) Value
83-32-9	Acenaphthene	mg/kg	4700	ND	4700
67-64-1	Acetone	mg/kg	7800	100000	7800
15972-60-8	Alachlor	mg/kg	8	ND	8
116-06-3	Aldicarb	mg/kg	78	ND	78
309-00-2	Aldrin	mg/kg	0.04	3	0.04
120-12-7	Anthracene	mg/kg	23000	ND	23000
1912-24-9	Atrazine	mg/kg	2700	ND	2700
71-43-2	Benzene	mg/kg	22	0.8	0.8
56-55-3	Benzo(a)anthracene	mg/kg	0.9	ND	0.9
205-99-2	Benzo(b)fluoranthene	mg/kg	0.9	ND	0.9
207-08-9	Benzo(k)fluoranthene	mg/kg	9	ND	9
50-32-8	Benzo(a)pyrene	mg/kg	0.09	ND	0.09
111-44-4	Bis(2-chloroethyl)ether	mg/kg	0.6	0.2	0.2
117-81-7	Bis(2-ethylhexyl)phthalate	mg/kg	46	31000	46
75-27-4	Bromodichloromethane	mg/kg	10	3000	10
75-25-2	Bromoform	mg/kg	81	53	53
71-36-3	Butanol	mg/kg	7800	10000	7800
85-68-7	Butyl benzyl phthalate	mg/kg	16000	930	930
86-74-8	Carbazole	mg/kg	32	ND	32
1563-66-2	Carbofuran	mg/kg	390	ND	390
75-15-0	Carbon disulfide	mg/kg	7800	720	720
56-23-5	Carbon tetrachloride	mg/kg	5	0.3	0.3
57-74-9	Chlordane	mg/kg	0.5	20	0.5
106-47-8	4-Chloroaniline (p-Chloroaniline)	mg/kg	310	ND	310
08-90-7	Chlorobenzene (Monochlorobenzene)	mg/kg	1600	130	130
124-48-1	Chlorodibromomethane	mg/kg	1600	1300	1300
67-66-3	Chloroform	mg/kg	100	0.3	0.3
218-01-9	Chrysene	mg/kg	88	ND	88
94-75-7	24-D	mg/kg	780	ND	780
75-99-0	Dalapon	mg/kg	2300	ND	2300
72-54-8	DDD	mg/kg	3	ND	3
72-55-9	DDE	mg/kg	2	ND	2
50-29-3	DDT	mg/kg	2	ND	2
53-70-3	Dibenzo(ah)anthracene	mg/kg	0.09	ND	0.09
96-12-8	12-Dibromo-3 chloropropane	mg/kg	0.46	11	0.46
106-93-4	12-Dibromoethane (Ethylene dibromide)	mg/kg	0.0075	0.17	0.0075
84-74-2	Di-n-butyl phthalate	mg/kg	7800	2300	2300
95-50-1	12-Dichlorobenzene (o - Dichlorobenzene)	mg/kg	7000	560	560
106-46-7	14-Dichlorobenzene (p - Dichlorobenzene)	mg/kg	ND	ND	NA
91-94-1	33'-Dichlorobenzidine	mg/kg	1	ND	1
75-34-3	11-Dichloroethane	mg/kg	7800	1300	1300
107-06-2	12-Dichloroethane (Ethylene dichloride)	mg/kg	7	0.4	0.4
75-35-4	11-Dichloroethylene	mg/kg	700	1500	700
156-59-2	cis-12-Dichloroethylene	mg/kg	780	1200	780
156-60-5	trans-12 Dichloroethylene	mg/kg	1600	3100	1600
78-87-5	12-Dichloropropane	mg/kg	9	15	9
542-75-6	13-Dichloropropene	mg/kg	4	0.1	0.1
60-57-1	Dieldrin	mg/kg	0.04	1	0.04
84-66-2	Diethyl phthalate	mg/kg	63000	2000	2000
105-67-9	24-Dimethylphenol	mg/kg	1600	ND	1600
121-14-2	24-Dinitrotoluene	mg/kg	0.9	ND	0.9
606-20-2	26-Dinitrotoluene	mg/kg	0.9	ND	0.9
117-84-0	Di-n-octyl phthalate	mg/kg	1600	10000	1600
115-29-7	Endosulfan	mg/kg	470	ND	470
145-73-3	Endothall	mg/kg	1600	ND	1600
2-20-8	Endrin	mg/kg	23	ND	23

Table C-1
 Residential Soil Direct-Contact Screening Values
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

CAS Number	Constituent	Units	Exposure Route-Specific Values for Soils (a)		
			Ingestion	Inhalation	Selected (Lowest) Value
100-41-4	Ethylbenzene	mg/kg	7800	400	400
206-44-0	Fluoranthene	mg/kg	3100	ND	3100
86-73-7	Fluorene	mg/kg	3100	ND	3100
76-44-8	Heptachlor	mg/kg	0.1	0.1	0.1
1024-57-3	Heptachlor epoxide	mg/kg	0.07	5	0.07
118-74-1	Hexachlorobenzene	mg/kg	0.4	1	0.4
319-84-6	alpha-HCH (alpha-BHC)	mg/kg	0.1	0.8	0.1
58-89-9	gamma-HCH (Lindane)	mg/kg	0.5	ND	0.5
77-47-4	Hexachlorocyclopentadiene	mg/kg	550	10	10
67-72-1	Hexachloroethane	mg/kg	78	ND	78
193-39-5	Indeno(123-cd)pyrene	mg/kg	0.9	ND	0.9
78-59-1	Isophorone	mg/kg	15600	4600	4600
72-43-5	Methoxychlor	mg/kg	390	ND	390
74-83-9	Methyl bromide (Bromomethane)	mg/kg	110	10	10
75-09-2	Methylene chloride (Dichloromethane)	mg/kg	85	13	13
95-48-7	2-Methylphenol (o - Cresol)	mg/kg	3900	ND	3900
91-20-3	Naphthalene	mg/kg	3100	ND	3100
98-95-3	Nitrobenzene	mg/kg	39	92	39
86-30-6	N-Nitrosodiphenylamine	mg/kg	130	ND	130
621-64-7	N-Nitrosodi-n propylamine	mg/kg	0.09	ND	0.09
108-95-2	Phenol	mg/kg	47000	ND	47000
1918-02-1	Picloram	mg/kg	5500	ND	5500
1336-36-3	Polychlorinated biphenyls (PCBs)	mg/kg	1	ND	1
129-00-0	Pyrene	mg/kg	2300	ND	2300
122-34-9	Simazine	mg/kg	390	ND	390
100-42-5	Styrene	mg/kg	16000	1500	1500
127-18-4	Tetrachloroethylene (Perchloroethylene)	mg/kg	12	11	11
108-88-3	Toluene	mg/kg	16000	650	650
8001-35-2	Toxaphene	mg/kg	0.6	89	0.6
120-82-1	124-Trichlorobenzene	mg/kg	780	3200	780
71-55-6	111-Trichloroethane	mg/kg	ND	1200	1200
79-00-5	112-Trichloroethane	mg/kg	310	1800	310
79-01-6	Trichloroethylene	mg/kg	58	5	5
108-05-4	Vinyl acetate	mg/kg	78000	1000	1000
75-01-4	Vinyl chloride	mg/kg	0.3	0.03	0.03
108-38-3	m-Xylene	mg/kg	160000	420	420
95-47-6	o-Xylene	mg/kg	160000	410	410
106-42-3	p-Xylene	mg/kg	160000	460	460
1330-20-7	Xylenes (total)	mg/kg	160000	410	410
	<u>Ionizable Organics</u>	mg/kg			0
65-85-0	Benzoic Acid	mg/kg	310000	ND	310000
95-57-8	2-Chlorophenol	mg/kg	390	53000	390
120-83-2	24-Dichlorophenol	mg/kg	230	ND	230
51-28-5	24-Dinitrophenol	mg/kg	160	ND	160
88-85-7	Dinoseb	mg/kg	78	ND	78
87-86-5	Pentachlorophenol	mg/kg	3	ND	3
93-72-1	245-TP (Silvex)	mg/kg	630	ND	630
95-95-4	245-Trichlorophenol	mg/kg	7800	ND	7800
88-06-2	246 Trichlorophenol	mg/kg	58	200	58

Table C-1
Residential Soil Direct-Contact Screening Values
Saugat Area 1 - Creek Bottom Soils
Human Health Risk Assessment

CAS Number	Constituent	Units	Exposure Route-Specific Values for Soils (a)		
			Ingestion	Inhalation	Selected (Lowest) Value
Inorganics					
7440-36-0	Antimony	mg/kg	31	ND	31
7440-38-2	Arsenic	mg/kg	0.4	750	0.4
7440-39-3	Barium	mg/kg	5500	690000	5500
7440-41-7	Beryllium	mg/kg	156 (n)	1340 (n)	156 (n)
7440-42-8	Boron	mg/kg	7000	ND	7000
7440-43-9	Cadmium	mg/kg	78	1800	78
16887-00-6	Chloride	mg/kg	ND	ND	NA
7440-47-3	Chromium total	mg/kg	390	270	270
16065-83-1	Chromium ion trivalent	mg/kg	78000	ND	78000
18540-29-9	Chromium (+6)	mg/kg	390	270	270
7440-48-4	Cobalt	mg/kg	4700	ND	4700
7440-50-8	Copper	mg/kg	2900	ND	2900
57-12-5	Cyanide	mg/kg	1600	ND	1600
7782-41-4	Fluoride	mg/kg	4700	ND	4700
15438-31-0	Iron	mg/kg	ND	ND	NA
7439-92-1	Lead	mg/kg	400	ND	400
7439-96-5	Manganese	mg/kg	3700	69000	3700
7439-97-6	Mercury	mg/kg	23	10	10
7440-02-0	Nickel	mg/kg	1600	13000	1600
14797-55-8	Nitrate as Np	mg/kg	130000	ND	130000
7782-49-2	Selenium	mg/kg	390	ND	390
7440-22-4	Silver	mg/kg	390	ND	390
14808-79-8	Sulfate	mg/kg	ND	ND	NA
7440-28-0	Thallium	mg/kg	6.3	ND	6.3
7440-62-2	Vanadium	mg/kg	550	ND	550
7440-66-6	Zinc	mg/kg	23000	ND	23000
Constituents Lacking TACO Standards					
93-76-5	2,4,5-T	mg/kg	--	--	610 (j)
94-82-6	2,4-DB	mg/kg	--	--	490 (j)
78-93-3	2-Butanone (MEK)	mg/kg	--	--	7300 (j)
591-78-6	2-Hexanone	mg/kg	--	--	790 (k)
91-57-6	2-Methylnaphthalene	mg/kg	--	--	3100 (h)
88-74-4	2-Nitroaniline	mg/kg	--	--	3.5 (j)
208-96-8	Acenaphthylene	mg/kg	--	--	4700 (b)
5103-71-9	Alpha Chlordane	mg/kg	--	--	0.5 (e)
7429-90-5	Aluminum	mg/kg	--	--	76 (j)
191-24-2	Benzo(g,h,i)perylene	mg/kg	--	--	2300 (i)
319-85-7	beta-BHC	mg/kg	--	--	0.1 (c)
319-86-8	delta-BHC	mg/kg	--	--	0.1 (c)
541-73-1	1,3-Dichlorobenzene	mg/kg	--	--	13 (p)
106-46-7	1,4-Dichlorobenzene	mg/kg	--	--	3.4 (p)
132-64-9	Dibenzofuran	mg/kg	--	--	290 (j)
1918-00-9	Dicamba	mg/kg	--	--	NA (j)
120-36-5	Dichloroprop	mg/kg	--	--	NA (l)
1746-01-6	Dioxin	mg/kg	--	--	0.001 (m)
959-98-8	Endosulfan I	mg/kg	--	--	470 (f)
33213-65-9	Endosulfan II	mg/kg	--	--	470 (f)
1031-07-8	Endosulfan sulfate	mg/kg	--	--	470 (f)
7421-93-4	Endrin aldehyde	mg/kg	--	--	23 (g)

Table C-1
 Residential Soil Direct-Contact Screening Values
 Saugat Area 1 - Creek Bottom Soils
 Human Health Risk Assessment

CAS Number	Constituent	Exposure Route-Specific Values for Soils (a)			
		Units	Ingestion	Inhalation	Selected (Lowest) Value
53494-70-5	Endrin ketone	mg/kg	--	--	23 (g)
5103-74-2	Gamma Chlordane	mg/kg	--	--	0.5 (e)
87-68-3	Hexachlorobutadiene	mg/kg	--	--	6.2 (p)
94-74-6	MCPA	mg/kg	--	--	31 (j)
7085-19-0	MCPP	mg/kg	--	--	61 (j)
106-44-5	3&4-methylphenol	mg/kg	--	--	310 (p)
108-10-1	MIBK	mg/kg	--	--	790 (p)
7439-98-7	Molybdenum	mg/kg	--	--	390 (j)
100-01-6	4-Nitroaniline	mg/kg	--	--	3.5 (p)
100-02-7	4-Nitrophenol	mg/kg	--	--	490 (p)
85-01-8	Phenanthrene	mg/kg	--	--	23000 (d)
79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	--	--	0.38 (p)
7440-31-5	Tin	mg/kg	--	--	47000 (p)

Notes:

CAS - Chemical Abstracts Service.

NA - Not Available.

ND - Not Determined.

TACO - Illinois Tiered Approach to Corrective Action.

(a) - Title 35, Subtitle G, Chapter I, Part 742 Illinois Tiered Approach to Corrective Action Objectives (TACO) Tier 1 values from Appendix B, Table A.

(b) - No TACO value available. Therefore, the TACO value for acenaphthene has been used due to structural similarity.

(c) - No TACO value available. Therefore, the TACO value for alpha-HCH has been used due to structural similarity.

(d) - No TACO value available. Therefore, the TACO value for anthracene has been used due to structural similarity.

(e) - No TACO value available. Therefore, the TACO value for chlordane has been used due to structural similarity.

(f) - No TACO value available. Therefore, the TACO value for endosulfan has been used due to structural similarity.

(g) - No TACO value available. Therefore, the TACO value for endrin has been used due to structural similarity.

(h) - No TACO value available. Therefore, the TACO value for naphthalene has been used due to structural similarity.

(i) - No TACO value available. Therefore, the TACO value for pyrene has been used due to structural similarity.

(j) - No TACO value, and no appropriate structural surrogate. Therefore, Region IX Preliminary Remediation Goal (PRG), 2000, used.

(k) - No TACO value, and no appropriate structural surrogate. Therefore, PRG for methyl-isobutyl-ketone.

(l) - No TACO value, PRG value, appropriate surrogate, or dose response value available.

(m) - Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites. OSWER Directive 9200.4-26. April 13, 1998.

(n) - Values for beryllium re-calculated based on new dose-response information from US EPA (Integrated Risk Information System, IRIS, 10/2000) using TACO SSL methodology as presented in Solutia, 2001, Appendix C.

(o) - Value used for 1,2-Dichloroethylene (total).

(p) - No TACO value, therefore PRG value used.

TABLE C-2
CALCULATIONS OF TIER 1 TACO STANDARDS FOR BERYLLIUM
USE OF CURRENT USEPA DOSE-RESPONSE VALUES
SAUGET AREA 1 - EE/CA AND RI/FS
HUMAN HEALTH RISK ASSESSMENT

PARAMETER	RESIDENTIAL		INDUSTRIAL/ COMMERCIAL	CONSTRUCTION WORKER
	Noncarcinogen	Carcinogen		
AT _{ing} (yr)	6.00	--	25.00	0.115
AT _{inh} (yr)	30.00	--	25.00	0.115
AT _c (yr)	--	70.00	70.00	70.00
BW (kg)	15.00	70.00	70.00	70.00
CONV(KG/MG)	1.00E-06	1.00E-06	1.00E-06	1.00E-06
CONV(UG/MG)	1.00E+03	1.00E+03	1.00E+03	1.00E+03
ED _{ing} (yr)	6.00	--	25.00	1.00
ED _{inh} (yr)	30.00	30.00	25.00	1.00
EF (d/yr)	350.00	350.00	250.00	30.00
IR _{soil} (mg/d)	200.00	--	50.00	480.00
PEF (m ³ /kg)	1.32E+09	1.32E+09	1.24E+09	--
PEF' (m ³ /kg)	--	--	--	1.24E+08
RfC (mg/m ³)	2.00E-05	--	2.00E-05	2.00E-05
RfDo (mg/(kg-d))	2.00E-03	--	2.00E-03	2.00E-03
THQ	1.00	--	1.00	1.00
TR	--	1.00E-06	1.00E-06	1.00E-06
URF (ug/m ³) ⁻¹	--	2.40E-03	2.40E-03	2.40E-03
YR(d/yr)	365.00	365.00	365.00	365.00
INGESTION: NONCARCINOGENIC	1.56E+02	--	4.09E+03	4.08E+02
INHALATION NONCARCINOGENIC	2.75E+04	--	3.62E+04	3.47E+03
CARCINOGENIC	--	1.34E+03	2.11E+03	4.40E+04

-- = Not Applicable

TACO - Tiered Approach to Corrective Action Objectives. Part 742, Subchapter F, Chapter I, Subtitle G,
 Title 35 of the Illinois Regulations, effective June 8, 1998.

EQUATION FOR SOIL INGESTION EXPOSURE ROUTE
NONCARCINOGENIC (MG/KG):

$$\frac{\text{THQ} * \text{BW} * \text{AT}_{\text{ing}} * \text{YR}}{(1/\text{RfDo}) * \text{CONV (kg/mg)} * \text{EF} * \text{ED}_{\text{ing}} * \text{IR}_{\text{soil}}}$$

EQUATION FOR INHALATION EXPOSURE ROUTE

NONCARCINOGENIC (MG/KG):

RESIDENTIAL, INDUSTRIAL/COMMERCIAL

$$\frac{\text{THQ} * \text{AT}_{\text{inh}} * \text{YR}}{\text{EF} * \text{ED}_{\text{inh}} * (1/\text{RfC}) * (1/\text{PEF})}$$

CONSTRUCTION WORKER

$$\frac{\text{THQ} * \text{AT}_{\text{inh}} * \text{YR}}{\text{EF} * \text{ED}_{\text{inh}} * (1/\text{RfC}) * (1/\text{PEF})}$$

CARCINOGENIC (MG/KG):
 RESIDENTIAL, INDUSTRIAL/COMMERCIAL

$$\frac{\text{TR} * \text{AT}_c * \text{YR}}{\text{URF} * \text{CONV(UG/MG)} * \text{EF} * \text{ED}_{\text{inh}} * (1/\text{PEF})}$$

CONSTRUCTION WORKER

$$\frac{\text{TR} * \text{AT}_c * \text{YR}}{\text{URF} * \text{CONV(UG/MG)} * \text{EF} * \text{ED}_{\text{inh}} * (1/\text{PEF})}$$

Attachment D

COPC Selection for Creek Bottom Soils for Residential Scenarios

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSB	71-55-6	1,1,1-Trichloroethane	mg/kg	3 : 48 : 49	4.15E-03	2.30E-02	No	ND	--	No	1.20E+03	No	No	<Tier I	No
CBS-CSB	120-82-1	1,2,4-Trichlorobenzene	mg/kg	6 : 49 : 49	2.28E+00	8.00E+01	No	ND	--	No	7.80E+02	No	No	<Tier I	No
CBS-CSB	95-50-1	1,2-Dichlorobenzene	mg/kg	6 : 49 : 49	1.67E+00	5.30E+01	No	ND	--	No	5.60E+02	No	No	<Tier I	No
CBS-CSB	540-59-0	1,2-Dichloroethene (total)	mg/kg	1 : 48 : 49	3.85E-03	1.20E-02	No	ND	--	No	7.80E+02	No	No	<Tier I	No
CBS-CSB	541-73-1	1,3-Dichlorobenzene	mg/kg	1 : 4 : 49	1.00E-01	1.00E-01	No	ND	--	No	1.30E+01	No	No	<Tier I	No
CBS-CSB	106-46-7	1,4-Dichlorobenzene	mg/kg	7 : 49 : 49	2.93E-01	5.50E+00	No	ND	--	No	3.40E+00	Yes	Yes	>Tier I	No
CBS-CSB	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	49 : 49 : 49	2.42E-04	4.54E-03	No	1.24E-05	Yes	No	1.00E-03	Yes	Yes	>Tier I	No
CBS-CSB	93-78-5	2,4,5-T	mg/kg	12 : 48 : 49	2.42E-04	6.10E-01	No	ND	--	No	6.10E+02	No	No	<Tier I	No
CBS-CSB	93-72-1	2,4,5-TP (Silvex)	mg/kg	3 : 3 : 49	2.42E-04	2.00E-03	No	ND	--	No	6.30E+02	No	No	<Tier I	No
CBS-CSB	95-95-4	2,4,5-Trichlorophenol	mg/kg	1 : 49 : 49	2.42E-04	2.40E-01	No	ND	--	No	7.80E+03	No	No	<Tier I	No
CBS-CSB	88-06-2	2,4,6-Trichlorophenol	mg/kg	5 : 49 : 49	2.42E-04	4.30E+00	No	ND	--	No	5.80E+01	No	No	<Tier I	No
CBS-CSB	94-75-7	2,4-D	mg/kg	3 : 47 : 49	2.42E-04	1.40E-01	No	2.03E-02	Yes	No	7.80E+02	No	No	<Tier I	No
CBS-CSB	94-82-6	2,4-DB	mg/kg	2 : 47 : 49	7.60E-03	5.70E-02	No	ND	--	No	4.90E+02	No	No	<Tier I	No
CBS-CSB	120-83-2	2,4-Dichlorophenol	mg/kg	5 : 49 : 49	2.69E-01	6.60E+00	No	ND	--	No	2.30E+02	No	No	<Tier I	No
CBS-CSB	78-93-3	2-Butanone (MEK)	mg/kg	29 : 48 : 49	3.50E-02	6.10E-01	No	4.99E-02	Yes	No	7.30E+03	No	No	<Tier I	No
CBS-CSB	95-57-8	2-Chlorophenol	mg/kg	3 : 49 : 49	1.25E-01	5.10E-01	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSB	591-79-6	2-Hexanone	mg/kg	1 : 48 : 49	1.98E-02	7.70E-02	No	ND	--	No	7.90E+02	No	No	<Tier I	No
CBS-CSB	91-57-6	2-Methylnaphthalene	mg/kg	3 : 49 : 49	3.53E-01	7.30E+00	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSB	106-44-5	3&4Methylphenol	mg/kg	1 : 49 : 49	1.48E-01	1.60E+00	No	ND	--	No	3.10E+02	No	No	<Tier I	No
CBS-CSB	72-54-8	4,4'-DDD	mg/kg	3 : 49 : 49	1.60E-02	4.70E-01	No	ND	--	No	3.00E+00	No	No	<Tier I	No
CBS-CSB	72-55-9	4,4'-DDE	mg/kg	2 : 44 : 49	3.59E-03	3.50E-02	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSB	50-29-3	4,4'-DDT	mg/kg	15 : 48 : 48	1.83E-02	1.60E-01	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSB	106-47-8	4-Chloroaniline	mg/kg	5 : 49 : 49	5.94E-01	1.10E+01	No	ND	--	No	3.10E+02	No	No	<Tier I	No
CBS-CSB	108-10-1	4-Methyl-2-pentanone (MIB)	mg/kg	5 : 48 : 49	2.03E-02	1.10E-01	No	ND	--	No	7.90E+02	No	No	<Tier I	No
CBS-CSB	100-01-6	4-Nitroaniline	mg/kg	2 : 49 : 49	7.59E-01	9.00E+00	No	ND	--	No	3.50E+00	Yes	Yes	>Tier I	No
CBS-CSB	100-02-7	4-Nitrophenol	mg/kg	1 : 1 : 49	4.40E-01	4.40E-01	No	ND	--	No	4.90E+02	No	No	<Tier I	No
CBS-CSB	83-32-9	Acenaphthene	mg/kg	2 : 49 : 49	1.32E-01	8.60E-01	No	ND	--	No	4.70E+03	No	No	<Tier I	No
CBS-CSB	208-96-8	Acenaphthylene	mg/kg	1 : 49 : 49	1.20E-01	2.40E-01	No	ND	--	No	4.70E+03	No	No	<Tier I	No
CBS-CSB	67-64-1	Acetone	mg/kg	38 : 48 : 49	1.16E-01	4.70E-01	No	1.56E-01	Yes	No	7.80E+03	No	No	<Tier I	No
CBS-CSB	309-00-2	Aldrin	mg/kg	1 : 1 : 49	3.60E-04	3.60E-04	No	ND	--	No	4.00E-02	No	No	<Tier I	No
CBS-CSB	319-84-6	alpha-BHC	mg/kg	9 : 44 : 49	5.85E-04	2.90E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSB	7429-95-5	Aluminum	mg/kg	49 : 49 : 49	9.35E+03	2.00E+04	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
CBS-CSB	120-12-7	Anthracene	mg/kg	4 : 49 : 49	1.48E-01	1.40E+00	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSB	7440-36-0	Antimony	mg/kg	4 : 46 : 49	1.45E+00	3.90E+00	No	2.75E+00	Yes	No	3.10E+01	No	No	<Tier I	No
CBS-CSB	7440-38-2	Arsenic	mg/kg	49 : 49 : 49	9.72E+00	4.40E+01	No	1.44E+01	Yes	No	4.00E-01	Yes	Yes	>Tier I	No
CBS-CSB	7440-39-3	Barium	mg/kg	49 : 49 : 49	2.98E+02	1.50E+03	No	4.13E+02	Yes	No	5.50E+03	No	No	<Tier I	No
CBS-CSB	71-43-2	Benzene	mg/kg	19 : 49 : 49	8.31E-03	1.80E-01	No	ND	--	No	8.00E-01	No	No	<Tier I	No
CBS-CSB	56-55-3	Benzo(a)anthracene	mg/kg	4 : 49 : 49	1.69E-01	1.90E+00	No	ND	--	No	9.00E-01	Yes	Yes	>Tier I	No
CBS-CSB	50-32-8	Benzo(a)pyrene	mg/kg	7 : 49 : 49	1.09E-01	1.20E+00	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSB	205-99-2	Benzo(b)fluoranthene	mg/kg	6 : 49 : 49	1.56E-01	1.40E+00	No	ND	--	No	9.00E-01	Yes	Yes	>Tier I	No
CBS-CSB	191-24-2	Benzo(g,h,i)perylene	mg/kg	6 : 49 : 49	1.38E-01	8.90E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSB	207-08-9	Benzo(k)fluoranthene	mg/kg	5 : 49 : 49	1.49E-01	9.00E-01	No	ND	--	No	9.00E+00	No	No	<Tier I	No
CBS-CSB	7440-41-7	Beryllium	mg/kg	36 : 49 : 49	5.39E-01	1.30E+00	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
CBS-CSB	319-85-7	beta-BHC	mg/kg	10 : 46 : 49	1.25E-03	7.70E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSB	117-81-7	Bis(2-ethylhexyl)phthalate	mg/kg	5 : 49 : 49	1.77E+00	8.10E+01	No	ND	--	No	4.60E+01	Yes	Yes	>Tier I	No
CBS-CSB	85-68-7	Butylbenzylphthalate	mg/kg	2 : 49 : 49	1.80E-01	3.20E+00	No	ND	--	No	9.30E+02	No	No	<Tier I	No
CBS-CSB	7440-43-9	Cadmium	mg/kg	46 : 49 : 49	8.25E+00	5.40E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No
CBS-CSB	7440-70-2	Calcium	mg/kg	49 : 49 : 49	6.49E+03	2.10E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
CBS-CSB	86-74-8	Carbazole	mg/kg	1 : 49 : 49	1.28E-01	6.20E-01	No	ND	--	No	3.20E+01	No	No	<Tier I	No
CBS-CSB	75-15-0	Carbon disulfide	mg/kg	19 : 48 : 49	1.10E-02	7.70E-02	No	ND	--	No	7.20E+02	No	No	<Tier I	No
CBS-CSB	108-90-7	Chlorobenzene	mg/kg	38 : 49 : 49	4.50E-01	9.70E+00	No	ND	--	No	1.30E+02	No	No	<Tier I	No
CBS-CSB	67-66-3	Chloroform	mg/kg	1 : 5 : 49	2.72E-03	3.10E-03	No	ND	--	No	3.00E-01	No	No	<Tier I	No
CBS-CSB	7440-47-3	Chromium	mg/kg	49 : 49 : 49	5.13E+01	1.80E+02	No	4.00E+01	Yes	No	2.70E+02	No	No	<Tier I	No
CBS-CSB	218-01-9	Chrysene	mg/kg	5 : 49 : 49	1.67E-01	1.90E+00	No	ND	--	No	8.80E+01	No	No	<Tier I	No
CBS-CSB	7440-48-4	Cobalt	mg/kg	49 : 49 : 49	8.55E+00	2.30E+01	No	1.72E+01	Yes	No	4.70E+03	No	No	<Tier I	No
CBS-CSB	7440-50-8	Copper	mg/kg	49 : 49 : 49	4.84E+02	1.00E+04	No	3.80E+01	Yes	No	2.90E+03	Yes	Yes	>Tier I	No
CBS-CSB	57-12-5	Cyanide	mg/kg	3 : 49 : 49	3.79E-01	1.10E+00	No	ND	--	No	1.60E+03	No	No	<Tier I	No
CBS-CSB	75-99-0	Dalapon	mg/kg	1 : 5 : 49	3.95E-02	4.10E-02	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSB	319-86-8	delta-BHC	mg/kg	2 : 44 : 49	5.27E-04	4.10E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSB	84-74-2	d-i-n-Butylphthalate	mg/kg	7 : 49 : 49	1.15E-01	2.10E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSB	53-70-3	Dibenz(a,h)anthracene	mg/kg	3 : 49 : 49	7.20E-02	3.40E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSB	132-64-9	Dibenzofuran	mg/kg	1 : 49 : 49	1.48E-01	1.60E+00	No	ND	--	No	2.90E+02	No	No	<Tier I	No
CBS-CSB	1918-00-9	Dicamba	mg/kg	12 : 12 : 49	2.84E-03	5.30E-03	No	ND	--	No	1.80E+03	No	No	<Tier I	No
CBS-CSB	120-36-5	Dichlorprop	mg/kg	1 : 1 : 49	6.60E-03	6.60E-03	No	ND	--	No	NA	No	No	<Tier I	--
CBS-CSB	60-57-1	Diekdrin	mg/kg	8 : 47 : 49	7.72E-03	4.90E-02	No	ND	--	No	4.00E-02	Yes	Yes	>Tier I	No
CBS-CSB	33213-65-9	Endosulfan II	mg/kg	1 : 42 : 49	2.60E-03	1.00E-02	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSB	1031-07-8	Endosulfan sulfate	mg/kg	1 : 44 : 49	2.85E-03	1.20E-02	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSB	53494-70-5	Endrin ketone	mg/kg	3 : 3 : 49	9.57E-04	1.50E-03	No	ND	--	No	2.30E+01	No	No	<Tier I	No
CBS-CSB	100-41-4	Ethylbenzene	mg/kg	7 : 49 : 49	1.14E-01	3.20E+00	No	ND	--	No	4.00E+02	No	No	<Tier I	No
CBS-CSB	206-44-0	Fluoranthene	mg/kg	9 : 49 : 49	2.35E-01	4.00E+00	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSB	86-73-7	Fluorene	mg/kg	2 : 49 : 49	1.86E-01	3.50E+00	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSB	58-89-9	gamma-BHC (Lindane)	mg/kg	10 : 40 : 49	1.09E-03	2.30E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSB	5103-74-2	gamma-Chlordane	mg/kg	2 : 2 : 49	3.90E-04	4.40E-04	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSB	76-44-8	Heptachlor	mg/kg	3 : 32 : 49	1.10E-03	1.20E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSB	1024-57-3	Heptachlor epoxide	mg/kg	14 : 49 : 49	1.43E-02	4.10E-01	No	ND	--	No	7.00E-02	Yes	Yes	>Tier I	No
CBS-CSB	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	4 : 49 : 49	1.39E-01	8.30E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSB	7439-89-6	Iron	mg/kg	49 : 49 : 49	1.38E+04	2.80E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--
CBS-CSB	7439-92-1	Lead	mg/kg	49 : 49 : 49	7.46E+01	7.00E+02	No	4.38E+01	Yes	No	4.00E+02	Yes	Yes	>Tier I	No
CBS-CSB	7439-95-4	Magnesium	mg/kg	49 : 49 : 49	3.72E+03	6.90E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
CBS-CSB	7439-96-5	Manganese	mg/kg	49 : 49 : 49	1.30E+02	5.30E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
CBS-CSB	7085-19-0	MCPP	mg/kg	3 : 47 : 49	1.61E+00	6.10E+00	No	ND	--	No	6.10E+01	No	No	<Tier I	No
CBS-CSB	7439-97-6	Mercury	mg/kg	48 : 49 : 49	1.34E-01	8.40E-01	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
CBS-CSB	72-43-5	Methoxychlor	mg/kg	6 : 6 : 49	1.72E-03	6.60E-03	No	ND	--	No	3.90E+02	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSB	75-09-2	Methylene chloride	mg/kg	4 : 6 : 49	2.39E-03	2.90E-03	No	ND	--	No	1.30E+01	No	No	<Tier I	No
CBS-CSB	7439-98-7	Molybdenum	mg/kg	27 : 49 : 49	7.79E-01	2.80E+00	No	8.90E-01	Yes	No	3.90E+02	No	No	<Tier I	No
CBS-CSB	86-30-6	N-Nitrosodiphenylamine	mg/kg	4 : 49 : 49	1.37E-01	1.20E+00	No	ND	--	No	1.30E+02	No	No	<Tier I	No
CBS-CSB	91-20-3	Naphthalene	mg/kg	5 : 49 : 49	2.61E-01	6.00E+00	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSB	7440-02-0	Nickel	mg/kg	49 : 49 : 49	1.92E+02	6.30E+02	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
CBS-CSB	98-85-3	Nitrobenzene	mg/kg	2 : 49 : 49	1.27E-01	5.20E-01	No	ND	--	No	3.90E+01	No	No	<Tier I	No
CBS-CSB	87-86-5	Pentachlorophenol	mg/kg	37 : 49 : 49	9.87E-01	4.40E+01	No	7.52E-01	Yes	No	3.00E+00	Yes	Yes	>Tier I	No
CBS-CSB	85-01-8	Phenanthrene	mg/kg	6 : 49 : 49	3.01E-01	7.00E+00	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSB	106-95-2	Phenol	mg/kg	3 : 49 : 49	1.85E-01	3.40E+00	No	ND	--	No	4.70E+04	No	No	<Tier I	No
CBS-CSB	7440-09-7	Potassium	mg/kg	49 : 49 : 49	1.76E+03	3.20E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
CBS-CSB	129-00-0	Pyrene	mg/kg	5 : 49 : 49	2.42E-01	4.00E+00	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSB	7782-49-2	Selenium	mg/kg	2 : 49 : 49	8.09E-01	4.50E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSB	7440-22-4	Silver	mg/kg	10 : 49 : 49	7.78E-01	9.00E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSB	7440-23-5	Sodium	mg/kg	49 : 49 : 49	1.99E+02	6.70E+02	Yes	ND	--	Yes	NA	No	No	EN	--
CBS-CSB	100-42-5	Styrene	mg/kg	1 : 3 : 49	2.50E-03	2.80E-03	No	ND	--	No	1.50E+03	No	No	<Tier I	No
CBS-CSB	127-18-4	Tetrachloroethene	mg/kg	3 : 48 : 49	5.27E-03	7.00E-02	No	ND	--	No	1.10E+01	No	No	<Tier I	No
CBS-CSB	7440-28-0	Thallium	mg/kg	3 : 49 : 49	6.29E-01	1.30E+00	No	ND	--	No	6.30E+00	No	No	<Tier I	No
CBS-CSB	7440-31-5	Tin	mg/kg	9 : 49 : 49	1.44E+01	4.70E+02	No	ND	--	No	4.70E+04	No	No	<Tier I	No
CBS-CSB	106-88-3	Toluene	mg/kg	16 : 49 : 49	1.46E-02	2.90E-01	No	ND	--	No	6.50E+02	No	No	<Tier I	No
CBS-CSB	1336-36-3	Total PCBs	mg/kg	38 : 49 : 49	2.78E+00	8.61E+01	No	ND	--	No	1.00E+00	Yes	Yes	>Tier I	No
CBS-CSB	79-01-6	Trichloroethene	mg/kg	3 : 48 : 49	4.48E-03	3.40E-02	No	ND	--	No	5.00E+00	No	No	<Tier I	No
CBS-CSB	7440-62-2	Vanadium	mg/kg	49 : 49 : 49	2.53E+01	4.70E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
CBS-CSB	1330-20-7	Xylenes (total)	mg/kg	13 : 49 : 49	7.64E-01	2.90E+01	No	ND	--	No	4.10E+02	No	No	<Tier I	No
CBS-CSB	7440-66-6	Zinc	mg/kg	49 : 49 : 49	2.16E+03	1.05E+04	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No
CBS-CSC	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	9 : 9 : 9	1.12E-05	3.66E-05	No	1.24E-05	Yes	No	1.00E-03	No	No	<Tier I	No
CBS-CSC	78-93-3	2-Butanone (MEK)	mg/kg	3 : 3 : 9	7.60E-03	9.90E-03	No	4.99E-02	No	Yes	7.30E+03	No	No	<Tier I	No
CBS-CSC	67-64-1	Acetone	mg/kg	5 : 9 : 9	3.42E-02	8.30E-02	No	1.56E-01	No	Yes	7.80E+03	No	No	<Tier I	No
CBS-CSC	5103-71-9	alpha-Chlordane	mg/kg	1 : 1 : 9	9.20E-04	9.20E-04	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSC	7429-90-5	Aluminum	mg/kg	9 : 9 : 9	1.08E+04	1.30E+04	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
CBS-CSC	7440-36-0	Antimony	mg/kg	1 : 1 : 9	7.90E-01	7.90E-01	No	2.75E+00	No	Yes	3.10E+01	No	No	<Tier I	No
CBS-CSC	7440-38-2	Arsenic	mg/kg	9 : 9 : 9	9.70E+00	1.40E+01	No	1.44E+01	No	Yes	4.00E-01	Yes	No	<BK	No
CBS-CSC	7440-39-3	Barium	mg/kg	9 : 9 : 9	2.49E+02	3.30E+02	No	4.13E+02	No	Yes	5.50E+03	No	No	<Tier I	No
CBS-CSC	71-43-2	Benzene	mg/kg	1 : 1 : 9	3.00E-03	3.00E-03	No	ND	--	No	8.00E-01	No	No	<Tier I	No
CBS-CSC	191-24-2	Benzog(h,i)perylene	mg/kg	1 : 1 : 9	6.50E-02	6.50E-02	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSC	7440-41-7	Beryllium	mg/kg	9 : 9 : 9	8.28E-01	9.60E-01	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
CBS-CSC	7440-43-9	Cadmium	mg/kg	9 : 9 : 9	1.33E+01	2.40E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No
CBS-CSC	7440-70-2	Calcium	mg/kg	9 : 9 : 9	7.81E+03	1.40E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
CBS-CSC	106-90-7	Chlorobenzene	mg/kg	9 : 9 : 9	1.30E-01	7.00E-01	No	ND	--	No	1.30E+02	No	No	<Tier I	No
CBS-CSC	7440-47-3	Chromium	mg/kg	9 : 9 : 9	3.61E+01	1.10E+02	No	4.00E+01	Yes	No	2.70E+02	No	No	<Tier I	No
CBS-CSC	7440-48-4	Cobalt	mg/kg	9 : 9 : 9	9.41E+00	1.40E+01	No	1.72E+01	No	Yes	4.70E+03	No	No	<Tier I	No
CBS-CSC	7440-50-8	Copper	mg/kg	9 : 9 : 9	1.09E+02	2.50E+02	No	3.80E+01	Yes	No	2.90E+03	No	No	<Tier I	No
CBS-CSC	319-86-8	delta-BHC	mg/kg	3 : 6 : 9	6.65E-04	9.90E-04	No	ND	--	No	1.00E-01	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSC	1918-00-9	Dicamba	mg/kg	1 : 1 : 9	6.60E-03	6.60E-03	No	ND	--	No	1.80E+03	No	No	<Tier I	No
CBS-CSC	120-36-5	Dichlorprop	mg/kg	1 : 1 : 9	6.20E-03	6.20E-03	No	ND	--	No	NA	No	No	<Tier I	--
CBS-CSC	60-57-1	Dieldrin	mg/kg	8 : 9 : 9	4.76E-03	1.10E-02	No	ND	--	No	4.00E-02	No	No	<Tier I	No
CBS-CSC	1031-07-8	Endosulfan sulfate	mg/kg	3 : 7 : 9	4.17E-03	7.00E-03	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSC	53494-70-5	Endrin ketone	mg/kg	1 : 6 : 9	5.73E-03	1.00E-02	No	ND	--	No	2.30E+01	No	No	<Tier I	No
CBS-CSC	5103-74-2	gamma-Chlordane	mg/kg	1 : 1 : 9	1.10E-03	1.10E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSC	7439-89-6	Iron	mg/kg	9 : 9 : 9	1.76E+04	2.10E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--
CBS-CSC	7439-92-1	Lead	mg/kg	9 : 9 : 9	4.32E+01	1.40E+02	No	4.38E+01	Yes	No	4.00E+02	No	No	<Tier I	No
CBS-CSC	7439-95-4	Magnesium	mg/kg	9 : 9 : 9	4.43E+03	6.70E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
CBS-CSC	7439-96-5	Manganese	mg/kg	9 : 9 : 9	1.89E+02	3.90E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
CBS-CSC	7439-97-6	Mercury	mg/kg	9 : 9 : 9	9.56E-02	3.10E-01	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
CBS-CSC	72-43-5	Methoxychlor	mg/kg	3 : 3 : 9	4.15E-03	7.10E-03	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSC	75-09-2	Methylene chloride	mg/kg	4 : 9 : 9	3.47E-03	4.80E-03	No	ND	--	No	1.30E+01	No	No	<Tier I	No
CBS-CSC	7440-02-0	Nickel	mg/kg	9 : 9 : 9	2.63E+02	5.70E+02	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
CBS-CSC	87-86-5	Pentachlorophenol	mg/kg	7 : 9 : 9	6.06E-03	1.40E-02	No	7.52E-01	No	Yes	3.00E+00	No	No	<Tier I	No
CBS-CSC	85-01-8	Phenanthrene	mg/kg	1 : 1 : 9	2.50E-02	2.50E-02	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSC	7440-09-7	Potassium	mg/kg	9 : 9 : 9	1.87E+03	2.30E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
CBS-CSC	7440-23-5	Sodium	mg/kg	9 : 9 : 9	1.24E+02	2.00E+02	Yes	ND	--	Yes	NA	No	No	EN	--
CBS-CSC	100-42-5	Styrene	mg/kg	1 : 1 : 9	2.70E-03	2.70E-03	No	ND	--	No	1.50E+03	No	No	<Tier I	No
CBS-CSC	7440-31-5	Tin	mg/kg	1 : 9 : 9	3.93E+00	7.50E+00	No	ND	--	No	4.70E+04	No	No	<Tier I	No
CBS-CSC	108-88-3	Toluene	mg/kg	4 : 9 : 9	4.13E-03	7.50E-03	No	ND	--	No	6.50E+02	No	No	<Tier I	No
CBS-CSC	1336-36-3	Total PCBs	mg/kg	6 : 9 : 9	6.91E-02	1.78E-01	No	ND	--	No	1.00E+00	No	No	<Tier I	No
CBS-CSC	7440-62-2	Vanadium	mg/kg	9 : 9 : 9	3.10E+01	3.70E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
CBS-CSC	1330-20-7	Xylenes (total)	mg/kg	1 : 9 : 9	3.74E-03	4.30E-03	No	ND	--	No	4.10E+02	No	No	<Tier I	No
CBS-CSC	7440-66-6	Zinc	mg/kg	9 : 9 : 9	2.14E+03	3.40E+03	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No
CBS-CSD	106-46-7	1,4-Dichlorobenzene	mg/kg	2 : 6 : 6	1.12E-01	1.30E-01	No	ND	--	No	3.40E+00	No	No	<Tier I	No
CBS-CSD	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	6 : 6 : 6	1.65E-04	8.86E-04	No	1.24E-05	Yes	No	1.00E-03	No	No	<Tier I	No
CBS-CSD	93-76-5	2,4,5-T	mg/kg	1 : 1 : 6	5.40E-03	5.40E-03	No	ND	--	No	6.10E+02	No	No	<Tier I	No
CBS-CSD	78-93-3	2-Butanone (MEK)	mg/kg	3 : 3 : 6	8.07E-03	1.00E-02	No	4.99E-02	No	Yes	7.30E+03	No	No	<Tier I	No
CBS-CSD	72-54-8	4,4'-DDD	mg/kg	1 : 1 : 6	1.40E-03	1.40E-03	No	ND	--	No	3.00E+00	No	No	<Tier I	No
CBS-CSD	50-29-3	4,4'-DDT	mg/kg	1 : 6 : 6	5.62E-02	2.40E-01	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSD	309-00-2	Aldrin	mg/kg	2 : 5 : 6	5.03E-03	9.00E-03	No	ND	--	No	4.00E-02	No	No	<Tier I	No
CBS-CSD	5103-71-9	alpha-Chlordane	mg/kg	1 : 5 : 6	6.78E-03	1.20E-02	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSD	7429-90-5	Aluminum	mg/kg	6 : 6 : 6	1.09E+04	1.40E+04	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
CBS-CSD	7440-38-2	Arsenic	mg/kg	6 : 6 : 6	1.14E+01	1.80E+01	No	1.44E+01	Yes	No	4.00E-01	Yes	Yes	>Tier I	No
CBS-CSD	7440-39-3	Barium	mg/kg	6 : 6 : 6	3.12E+02	5.70E+02	No	4.13E-02	Yes	No	5.50E+03	No	No	<Tier I	No
CBS-CSD	50-32-8	Benz(a)pyrene	mg/kg	3 : 6 : 6	8.48E-02	1.40E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSD	205-99-2	Benz(b)fluoranthene	mg/kg	1 : 6 : 6	1.36E-01	2.00E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSD	191-24-2	Benz(g,h,i)perylene	mg/kg	2 : 6 : 6	1.40E-01	2.20E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSD	207-08-9	Benz(k)fluoranthene	mg/kg	1 : 6 : 6	1.38E-01	2.10E-01	No	ND	--	No	9.00E+00	No	No	<Tier I	No
CBS-CSD	7440-41-7	Beryllium	mg/kg	6 : 6 : 6	8.38E-01	9.90E-01	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
CBS-CSD	7440-43-9	Cadmium	mg/kg	6 : 6 : 6	1.96E+01	4.00E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSD	7440-70-2	Calcium	mg/kg	6 : 6 : 6	8.53E+03	2.50E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
CBS-CSD	108-90-7	Chlorobenzene	mg/kg	5 : 6 : 6	3.13E-02	1.50E-01	No	ND	--	No	1.30E+02	No	No	<Tier I	No
CBS-CSD	7440-47-3	Chromium	mg/kg	6 : 6 : 6	4.93E+01	5.70E+01	No	4.00E+01	Yes	No	2.70E+02	No	No	<Tier I	No
CBS-CSD	7440-48-4	Cobalt	mg/kg	6 : 6 : 6	9.47E+00	1.20E+01	No	1.72E+01	No	Yes	4.70E+03	No	No	<Tier I	No
CBS-CSD	7440-50-8	Copper	mg/kg	6 : 6 : 6	3.86E+02	1.80E+03	No	3.80E+01	Yes	No	2.90E+03	No	No	<Tier I	No
CBS-CSD	75-99-0	Dalapon	mg/kg	1 : 6 : 6	4.75E-02	5.00E-02	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSD	319-86-8	delta-BHC	mg/kg	4 : 5 : 6	8.24E-04	1.90E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSD	1918-00-9	Dicamba	mg/kg	1 : 1 : 6	1.80E-03	1.80E-03	No	ND	--	No	1.80E+03	No	No	<Tier I	No
CBS-CSD	120-36-5	Dichlorprop	mg/kg	1 : 1 : 6	2.10E-02	2.10E-02	No	ND	--	No	NA	No	No	<Tier I	--
CBS-CSD	60-57-1	Dieldrin	mg/kg	5 : 6 : 6	1.27E-01	6.90E-01	No	ND	--	No	4.00E-02	Yes	Yes	>Tier I	No
CBS-CSD	1031-07-8	Endosulfan sulfate	mg/kg	1 : 2 : 6	7.10E-03	9.50E-03	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSD	206-44-0	Fluoranthene	mg/kg	4 : 6 : 6	1.31E-01	1.90E-01	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSD	5103-74-2	gamma-Chlordane	mg/kg	2 : 6 : 6	1.55E-02	6.70E-02	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSD	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	2 : 6 : 6	1.30E-01	1.80E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSD	7439-89-6	Iron	mg/kg	6 : 6 : 6	1.72E+04	2.00E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--
CBS-CSD	7439-92-1	Lead	mg/kg	6 : 6 : 6	9.82E+01	2.80E+02	No	4.38E+01	Yes	No	4.00E+02	No	No	<Tier I	No
CBS-CSD	7439-95-4	Magnesium	mg/kg	6 : 6 : 6	3.77E+03	5.00E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
CBS-CSD	7439-98-5	Manganese	mg/kg	6 : 6 : 6	1.37E+02	1.90E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
CBS-CSD	7439-97-6	Mercury	mg/kg	6 : 6 : 6	2.38E-01	7.10E-01	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
CBS-CSD	72-43-5	Methoxychlor	mg/kg	3 : 4 : 6	2.47E-02	6.20E-02	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSD	75-09-2	Methylene chloride	mg/kg	4 : 4 : 6	2.68E-03	3.20E-03	No	ND	--	No	1.30E+01	No	No	<Tier I	No
CBS-CSD	7439-98-7	Molybdenum	mg/kg	2 : 6 : 6	2.33E+00	7.00E+00	No	8.90E-01	Yes	No	3.90E+02	No	No	<Tier I	No
CBS-CSD	7440-02-0	Nickel	mg/kg	6 : 6 : 6	2.87E+02	5.30E+02	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
CBS-CSD	87-86-5	Pentachlorophenol	mg/kg	5 : 6 : 6	6.90E-03	1.30E-02	No	7.52E-01	No	Yes	3.00E+00	No	No	<Tier I	No
CBS-CSD	85-01-8	Phenanthrene	mg/kg	2 : 4 : 6	1.01E-01	1.20E-01	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSD	7440-09-7	Potassium	mg/kg	6 : 6 : 6	1.80E+03	2.10E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
CBS-CSD	129-00-0	Pyrene	mg/kg	3 : 6 : 6	1.32E-01	1.60E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSD	7782-49-2	Selenium	mg/kg	1 : 5 : 6	1.27E+00	2.80E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSD	7440-22-4	Silver	mg/kg	1 : 6 : 6	8.25E-01	1.50E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSD	7440-23-5	Sodium	mg/kg	6 : 6 : 6	1.75E+02	3.30E+02	Yes	ND	--	Yes	NA	No	No	EN	--
CBS-CSD	7440-31-5	Tin	mg/kg	2 : 6 : 6	5.23E+00	1.10E+01	No	ND	--	No	4.70E+04	No	No	<Tier I	No
CBS-CSD	108-88-3	Toluene	mg/kg	1 : 1 : 6	2.90E-03	2.90E-03	No	ND	--	No	6.50E+02	No	No	<Tier I	No
CBS-CSD	1336-36-3	Total PCBs	mg/kg	5 : 6 : 6	4.92E-01	2.44E+00	No	ND	--	No	1.00E+00	Yes	Yes	>Tier I	No
CBS-CSD	7440-62-2	Vanadium	mg/kg	6 : 6 : 6	3.15E+01	3.60E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
CBS-CSD	7440-86-6	Zinc	mg/kg	6 : 6 : 6	4.10E+03	8.20E+03	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No
CBS-CSE	106-46-7	1,4-Dichlorobenzene	mg/kg	1 : 17 : 17	1.30E-01	2.30E-01	No	ND	--	No	3.40E+00	No	No	<Tier I	No
CBS-CSE	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	14 : 17 : 17	3.06E-05	1.05E-04	No	1.24E-05	Yes	No	1.00E-03	No	No	<Tier I	No
CBS-CSE	94-75-7	2,4-D	mg/kg	2 : 17 : 17	8.34E-03	3.50E-02	No	2.03E-02	Yes	No	7.80E+02	No	No	<Tier I	No
CBS-CSE	78-93-3	2-Butanone (MEK)	mg/kg	5 : 5 : 17	1.06E-02	1.40E-02	No	4.99E-02	No	Yes	7.30E+03	No	No	<Tier I	No
CBS-CSE	72-54-8	4,4'-DDD	mg/kg	2 : 17 : 17	6.19E-03	4.70E-02	No	ND	--	No	3.00E+00	No	No	<Tier I	No
CBS-CSE	72-55-9	4,4'-DDE	mg/kg	6 : 15 : 17	2.06E-03	7.20E-03	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSE	50-29-3	4,4'-DDT	mg/kg	7 : 17 : 17	4.53E-03	1.70E-02	No	ND	--	No	2.00E+00	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSE	67-64-1	Acetone	mg/kg	9 : 17 : 17	3.78E-02	7.30E-02	No	1.56E-01	No	Yes	7.80E+03	No	No	<Tier I	No
CBS-CSE	319-84-6	alpha-BHC	mg/kg	1 : 15 : 17	4.21E-04	1.30E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSE	5103-71-9	alpha-Chlordane	mg/kg	1 : 17 : 17	2.31E-03	8.70E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSE	7429-90-5	Aluminum	mg/kg	17 : 17 : 17	9.97E+03	1.40E+04	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
CBS-CSE	120-12-7	Anthracene	mg/kg	1 : 1 : 17	5.00E-02	5.00E-02	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSE	7440-36-0	Antimony	mg/kg	3 : 17 : 17	1.43E+00	4.70E+00	No	2.75E+00	Yes	No	3.10E+01	No	No	<Tier I	No
CBS-CSE	7440-38-2	Arsenic	mg/kg	16 : 17 : 17	8.08E+00	2.00E+01	No	1.44E+01	Yes	No	4.00E-01	Yes	Yes	>Tier I	No
CBS-CSE	7440-39-3	Barium	mg/kg	17 : 17 : 17	2.52E+02	6.40E+02	No	4.13E+02	Yes	No	5.50E+03	No	No	<Tier I	No
CBS-CSE	56-55-3	Benzo(a)anthracene	mg/kg	3 : 17 : 17	1.26E-01	2.60E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSE	50-32-8	Benzo(a)pyrene	mg/kg	3 : 17 : 17	8.97E-02	4.20E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSE	205-99-2	Benzo(b)fluoranthene	mg/kg	4 : 17 : 17	1.41E-01	5.10E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSE	191-24-2	Benzo(g,h,i)perylene	mg/kg	3 : 17 : 17	1.35E-01	3.50E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSE	207-08-9	Benzo(k)fluoranthene	mg/kg	3 : 17 : 17	1.35E-01	3.70E-01	No	ND	--	No	9.00E+00	No	No	<Tier I	No
CBS-CSE	7440-41-7	Beryllium	mg/kg	17 : 17 : 17	7.44E-01	1.10E+00	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
CBS-CSE	117-81-7	Bis(2-ethylhexyl)phthalate	mg/kg	1 : 1 : 17	7.70E-02	7.70E-02	No	ND	--	No	4.60E+01	No	No	<Tier I	No
CBS-CSE	7440-43-9	Cadmium	mg/kg	17 : 17 : 17	1.42E+01	3.80E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No
CBS-CSE	7440-70-2	Calcium	mg/kg	17 : 17 : 17	8.02E+03	1.30E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
CBS-CSE	108-90-7	Chlorobenzene	mg/kg	12 : 17 : 17	2.33E-02	2.10E-01	No	ND	--	No	1.30E+02	No	No	<Tier I	No
CBS-CSE	7440-47-3	Chromium	mg/kg	17 : 17 : 17	4.73E+01	1.70E+02	No	4.00E+01	Yes	No	2.70E+02	No	No	<Tier I	No
CBS-CSE	218-01-9	Chrysene	mg/kg	4 : 17 : 17	1.32E-01	3.70E-01	No	ND	--	No	8.80E+01	No	No	<Tier I	No
CBS-CSE	7440-48-4	Cobalt	mg/kg	17 : 17 : 17	8.08E+00	1.30E+01	No	1.72E+01	No	Yes	4.70E+03	No	No	<Tier I	No
CBS-CSE	7440-50-8	Copper	mg/kg	17 : 17 : 17	4.25E+02	4.30E+03	No	3.80E+01	Yes	No	2.90E+03	Yes	Yes	>Tier I	No
CBS-CSE	84-74-2	di-n-Butylphthalate	mg/kg	1 : 1 : 17	7.40E-02	7.40E-02	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSE	53-70-3	Dibenz(a,h)anthracene	mg/kg	1 : 17 : 17	6.93E-02	1.40E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSE	1918-00-9	Dicamba	mg/kg	1 : 1 : 17	2.50E-03	2.50E-03	No	ND	--	No	1.80E+03	No	No	<Tier I	No
CBS-CSE	60-57-1	Dieldrin	mg/kg	13 : 17 : 17	5.49E-03	3.40E-02	No	ND	--	No	4.00E-02	No	No	<Tier I	No
CBS-CSE	959-98-8	Endosulfan I	mg/kg	3 : 3 : 17	1.43E-04	1.70E-04	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSE	33213-65-9	Endosulfan II	mg/kg	1 : 1 : 17	6.60E-04	6.60E-04	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSE	1031-07-8	Endosulfan sulfate	mg/kg	2 : 17 : 17	3.56E-03	1.60E-02	No	ND	--	No	4.70E+02	No	No	<Tier I	No
CBS-CSE	100-41-4	Ethylbenzene	mg/kg	1 : 17 : 17	3.64E-03	4.90E-03	No	ND	--	No	4.00E+02	No	No	<Tier I	No
CBS-CSE	206-44-0	Fluoranthene	mg/kg	4 : 17 : 17	1.63E-01	7.10E-01	No	ND	--	No	3.10E+03	No	No	<Tier I	No
CBS-CSE	5103-74-2	gamma-Chlordane	mg/kg	2 : 16 : 17	1.66E-03	5.50E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSE	1024-57-3	Heptachlor epoxide	mg/kg	5 : 5 : 17	4.34E-04	5.90E-04	No	ND	--	No	7.00E-02	No	No	<Tier I	No
CBS-CSE	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	2 : 17 : 17	1.38E-01	3.50E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSE	7439-89-6	Iron	mg/kg	17 : 17 : 17	1.78E+04	2.70E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--
CBS-CSE	7439-92-1	Lead	mg/kg	17 : 17 : 17	7.85E+01	4.00E+02	No	4.38E+01	Yes	No	4.00E+02	No	No	<Tier I	No
CBS-CSE	7439-95-4	Magnesium	mg/kg	17 : 17 : 17	4.51E+03	6.90E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
CBS-CSE	7439-96-5	Manganese	mg/kg	17 : 17 : 17	1.73E+02	3.00E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
CBS-CSE	7439-97-6	Mercury	mg/kg	17 : 17 : 17	4.06E-01	1.60E+00	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
CBS-CSE	72-43-5	Methoxychlor	mg/kg	3 : 3 : 17	7.20E-04	8.90E-04	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSE	75-09-2	Methylene chloride	mg/kg	3 : 6 : 17	2.78E-03	3.25E-03	No	ND	--	No	1.30E+01	No	No	<Tier I	No
CBS-CSE	7439-98-7	Molybdenum	mg/kg	2 : 17 : 17	3.84E-01	1.50E+00	No	8.90E-01	Yes	No	3.90E+02	No	No	<Tier I	No

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSE	7440-02-0	Nickel	mg/kg	17 : 17 : 17	1.81E+02	6.00E+02	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
CBS-CSE	87-86-5	Pentachlorophenol	mg/kg	7 : 17 : 17	1.13E-02	3.30E-02	No	7.52E-01	No	Yes	3.00E+00	No	No	<Tier I	No
CBS-CSE	85-01-8	Phenanthrene	mg/kg	4 : 17 : 17	1.26E-01	2.90E-01	No	ND	--	No	2.30E+04	No	No	<Tier I	No
CBS-CSE	7440-09-7	Potassium	mg/kg	17 : 17 : 17	2.07E+03	2.90E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
CBS-CSE	129-00-0	Pyrene	mg/kg	3 : 17 : 17	1.48E-01	4.80E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSE	7440-22-4	Silver	mg/kg	3 : 17 : 17	1.20E+00	9.80E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
CBS-CSE	7440-23-5	Sodium	mg/kg	17 : 17 : 17	2.41E+02	3.90E+02	Yes	ND	--	Yes	NA	No	No	EN	--
CBS-CSE	7440-28-0	Thallium	mg/kg	1 : 16 : 17	6.61E-01	8.80E-01	No	ND	--	No	6.30E+00	No	No	<Tier I	No
CBS-CSE	7440-31-5	Tin	mg/kg	3 : 17 : 17	5.60E+00	3.10E+01	No	ND	--	No	4.70E+04	No	No	<Tier I	No
CBS-CSE	108-88-3	Toluene	mg/kg	3 : 17 : 17	3.70E-03	4.45E-03	No	ND	--	No	6.50E+02	No	No	<Tier I	No
CBS-CSE	1336-36-3	Total PCBs	mg/kg	10 : 17 : 17	1.87E-01	1.25E+00	No	ND	--	No	1.00E+00	Yes	Yes	>Tier I	No
CBS-CSE	7440-62-2	Vanadium	mg/kg	17 : 17 : 17	2.95E+01	3.90E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
CBS-CSE	7440-66-6	Zinc	mg/kg	17 : 17 : 17	1.92E+03	5.90E+03	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No
CBS-CSF	79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	1 : 16 : 16	3.91E-03	1.00E-02	No	ND	--	No	3.80E-01	No	No	<Tier I	No
CBS-CSF	79-00-5	1,1,2-Trichloroethane	mg/kg	1 : 16 : 16	3.67E-03	6.10E-03	No	ND	--	No	3.10E+02	No	No	<Tier I	No
CBS-CSF	107-06-2	1,2-Dichloroethane	mg/kg	1 : 1 : 16	2.10E-03	2.10E-03	No	ND	--	No	4.00E-01	No	No	<Tier I	No
CBS-CSF	106-46-7	1,4-Dichlorobenzene	mg/kg	1 : 1 : 16	9.40E-02	9.40E-02	No	ND	--	No	3.40E+00	No	No	<Tier I	No
CBS-CSF	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	16 : 16 : 16	8.91E-05	7.89E-04	No	1.24E-05	Yes	No	1.00E-03	No	No	<Tier I	No
CBS-CSF	94-75-7	2,4-D	mg/kg	3 : 16 : 16	7.00E-03	2.63E-02	No	2.03E-02	Yes	No	7.80E+02	No	No	<Tier I	No
CBS-CSF	78-93-3	2-Butanone (MEK)	mg/kg	7 : 8 : 16	1.03E-02	1.40E-02	No	4.99E-02	No	Yes	7.30E+03	No	No	<Tier I	No
CBS-CSF	72-55-9	4,4'-DDE	mg/kg	4 : 4 : 15	1.01E-03	1.60E-03	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSF	50-29-3	4,4'-DDT	mg/kg	3 : 15 : 15	3.42E-03	7.50E-03	No	ND	--	No	2.00E+00	No	No	<Tier I	No
CBS-CSF	67-64-1	Acetone	mg/kg	7 : 16 : 16	4.22E-02	6.40E-02	No	1.56E-01	No	Yes	7.80E+03	No	No	<Tier I	No
CBS-CSF	309-00-2	Aldrin	mg/kg	1 : 1 : 16	2.30E-04	2.30E-04	No	ND	--	No	4.00E-02	No	No	<Tier I	No
CBS-CSF	5103-71-9	alpha-Chlordane	mg/kg	2 : 15 : 16	1.97E-03	4.10E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
CBS-CSF	7429-90-5	Aluminum	mg/kg	16 : 16 : 16	8.86E+03	1.20E+04	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
CBS-CSF	7440-36-0	Antimony	mg/kg	2 : 3 : 16	6.27E-01	6.80E-01	No	2.75E+00	No	Yes	3.10E+01	No	No	<Tier I	No
CBS-CSF	7440-38-2	Arsenic	mg/kg	15 : 16 : 16	9.71E+00	1.90E+01	No	1.44E+01	Yes	No	4.00E-01	Yes	Yes	>Tier I	No
CBS-CSF	7440-39-3	Barium	mg/kg	16 : 16 : 16	2.19E+02	3.30E+02	No	4.13E+02	No	Yes	5.50E+03	No	No	<Tier I	No
CBS-CSF	56-55-3	Benzo(a)anthracene	mg/kg	4 : 4 : 16	6.23E-02	9.20E-02	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSF	50-32-8	Benzo(a)pyrene	mg/kg	5 : 16 : 16	6.95E-02	1.90E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
CBS-CSF	205-89-2	Benzo(b)fluoranthene	mg/kg	5 : 16 : 16	1.14E-01	1.80E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
CBS-CSF	191-24-2	Benzo(g,h,i)perylene	mg/kg	5 : 15 : 16	1.07E-01	1.30E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
CBS-CSF	207-08-9	Benzo(k)fluoranthene	mg/kg	4 : 15 : 16	1.10E-01	1.30E-01	No	ND	--	No	9.00E+00	No	No	<Tier I	No
CBS-CSF	7440-41-7	Beryllium	mg/kg	13 : 16 : 16	6.10E-01	8.90E-01	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
CBS-CSF	319-85-7	beta-BHC	mg/kg	1 : 16 : 16	8.21E-04	3.90E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
CBS-CSF	117-81-7	Bis(2-ethylhexyl)phthalate	mg/kg	4 : 6 : 16	9.06E-02	1.10E-01	No	ND	--	No	4.60E+01	No	No	<Tier I	No
CBS-CSF	75-27-4	Bromodichloromethane	mg/kg	1 : 1 : 16	1.30E-03	1.30E-03	No	ND	--	No	1.00E+01	No	No	<Tier I	No
CBS-CSF	75-26-2	Bromoform	mg/kg	1 : 2 : 16	2.95E-03	3.00E-03	No	ND	--	No	5.30E+01	No	No	<Tier I	No
CBS-CSF	7440-43-9	Cadmium	mg/kg	15 : 16 : 16	2.03E+01	5.70E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No
CBS-CSF	7440-70-2	Calcium	mg/kg	16 : 16 : 16	9.80E+03	1.70E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
CBS-CSF	108-90-7	Chlorobenzene	mg/kg	3 : 16 : 16	4.41E-03	1.40E-02	No	ND	--	No	1.30E+02	No	No	<Tier I	No

TABLE D-1
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HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
CBS-CSF	7440-47-3	Chromium	mg/kg	16 : 16 : 16	1.68E+01	2.90E+01	No	4.00E+01	No	Yes	2.70E+02	No	No	<Tier I	No
CBS-CSF	218-01-9	Chrysene	mg/kg	5 : 16 : 16	1.08E-01	1.40E-01	No	ND	..	No	8.80E+01	No	No	<Tier I	No
CBS-CSF	7440-48-4	Cobalt	mg/kg	16 : 16 : 16	8.84E+00	1.30E+01	No	1.72E+01	No	Yes	4.70E+03	No	No	<Tier I	No
CBS-CSF	7440-50-8	Copper	mg/kg	16 : 16 : 16	1.20E+02	5.05E+02	No	3.80E+01	Yes	No	2.90E+03	No	No	<Tier I	No
CBS-CSF	57-12-5	Cyanide	mg/kg	2 : 16 : 16	6.56E-01	4.57E+00	No	ND	..	No	1.60E+03	No	No	<Tier I	No
CBS-CSF	124-48-1	Dibromochloromethane	mg/kg	1 : 1 : 16	2.00E-03	2.00E-03	No	ND	..	No	1.30E+03	No	No	<Tier I	No
CBS-CSF	1918-00-9	Dicamba	mg/kg	4 : 4 : 16	4.09E-03	6.25E-03	No	ND	..	No	1.80E+03	No	No	<Tier I	No
CBS-CSF	60-57-1	Dieldrin	mg/kg	9 : 16 : 16	2.30E-03	8.20E-03	No	ND	..	No	4.00E-02	No	No	<Tier I	No
CBS-CSF	1031-07-8	Endosulfan sulfate	mg/kg	1 : 10 : 16	2.73E-03	4.30E-03	No	ND	..	No	4.70E+02	No	No	<Tier I	No
CBS-CSF	206-44-0	Fluoranthene	mg/kg	5 : 16 : 16	1.12E-01	1.70E-01	No	ND	..	No	3.10E+03	No	No	<Tier I	No
CBS-CSF	5103-74-2	gamma-Chlordane	mg/kg	6 : 16 : 16	1.52E-03	3.80E-03	No	ND	..	No	5.00E-01	No	No	<Tier I	No
CBS-CSF	87-68-3	Hexachlorobutadiene	mg/kg	1 : 1 : 16	6.10E-02	6.10E-02	No	ND	..	No	6.20E+00	No	No	<Tier I	No
CBS-CSF	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	2 : 5 : 16	1.06E-01	1.10E-01	No	ND	..	No	9.00E-01	No	No	<Tier I	No
CBS-CSF	7439-89-6	Iron	mg/kg	16 : 16 : 16	1.93E+04	4.10E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--
CBS-CSF	7439-92-1	Lead	mg/kg	16 : 16 : 16	5.81E+01	4.50E+02	No	4.38E+01	Yes	No	4.00E+02	Yes	Yes	>Tier I	No
CBS-CSF	7439-95-4	Magnesium	mg/kg	16 : 16 : 16	5.27E+03	8.20E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
CBS-CSF	7439-96-5	Manganese	mg/kg	16 : 16 : 16	3.35E+02	8.90E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
CBS-CSF	7085-19-0	MCPP	mg/kg	1 : 16 : 16	1.46E+00	2.30E+00	No	ND	..	No	6.10E+01	No	No	<Tier I	No
CBS-CSF	7439-97-6	Mercury	mg/kg	16 : 16 : 16	1.91E-01	8.20E-01	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
CBS-CSF	75-09-2	Methylene chloride	mg/kg	4 : 15 : 16	3.26E-03	4.30E-03	No	ND	..	No	1.30E+01	No	No	<Tier I	No
CBS-CSF	7439-98-7	Molybdenum	mg/kg	2 : 16 : 16	5.90E-01	2.20E+00	No	8.90E-01	Yes	No	3.90E+02	No	No	<Tier I	No
CBS-CSF	7440-02-0	Nickel	mg/kg	16 : 16 : 16	1.67E+02	6.30E+02	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
CBS-CSF	87-86-5	Pentachlorophenol	mg/kg	8 : 16 : 16	9.11E-03	2.40E-02	No	7.52E-01	No	Yes	3.00E+00	No	No	<Tier I	No
CBS-CSF	85-01-8	Phenanthrene	mg/kg	4 : 4 : 16	5.93E-02	9.80E-02	No	ND	..	No	2.30E+04	No	No	<Tier I	No
CBS-CSF	7440-09-7	Potassium	mg/kg	16 : 16 : 16	1.59E+03	2.30E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
CBS-CSF	129-00-0	Pyrene	mg/kg	2 : 16 : 16	1.21E-01	1.60E-01	No	ND	..	No	2.30E+03	No	No	<Tier I	No
CBS-CSF	7782-49-2	Selenium	mg/kg	1 : 15 : 16	6.89E-01	1.80E+00	No	ND	..	No	3.90E+02	No	No	<Tier I	No
CBS-CSF	7440-22-4	Silver	mg/kg	1 : 16 : 16	6.65E-01	7.90E-01	No	ND	..	No	3.90E+02	No	No	<Tier I	No
CBS-CSF	7440-23-5	Sodium	mg/kg	15 : 16 : 16	1.38E+02	2.90E+02	Yes	ND	..	Yes	NA	No	No	EN	--
CBS-CSF	7440-31-5	Tin	mg/kg	1 : 16 : 16	3.77E+00	1.70E+01	No	ND	..	No	4.70E+04	No	No	<Tier I	No
CBS-CSF	108-88-3	Toluene	mg/kg	8 : 16 : 16	4.31E-03	7.70E-03	No	ND	..	No	6.50E+02	No	No	<Tier I	No
CBS-CSF	1336-36-3	Total PCBs	mg/kg	7 : 16 : 16	6.75E-02	3.57E-01	No	ND	..	No	1.00E+00	No	No	<Tier I	No
CBS-CSF	7440-62-2	Vanadium	mg/kg	16 : 16 : 16	2.57E+01	3.40E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
CBS-CSF	1330-20-7	Xylenes (total)	mg/kg	1 : 15 : 16	3.39E-03	4.05E-03	No	ND	..	No	4.10E+02	No	No	<Tier I	No
CBS-CSF	7440-66-6	Zinc	mg/kg	16 : 16 : 16	2.24E+03	1.50E+04	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No
SITE M	120-82-1	1,2,4-Trichlorobenzene	mg/kg	2 : 5 : 9	1.04E-01	1.60E-01	No	ND	..	No	7.80E+02	No	No	<Tier I	No
SITE M	95-50-1	1,2-Dichlorobenzene	mg/kg	1 : 5 : 9	1.29E-01	2.10E-01	No	ND	..	No	5.60E+02	No	No	<Tier I	No
SITE M	106-46-7	1,4-Dichlorobenzene	mg/kg	3 : 9 : 9	9.78E-01	4.10E+00	No	ND	..	No	3.40E+00	Yes	Yes	>Tier I	No
SITE M	1746-01-6	2,3,7,8-TCDD-TEQ	mg/kg	9 : 9 : 9	9.59E-04	5.23E-03	No	1.24E-05	Yes	No	1.00E-03	Yes	Yes	>Tier I	No
SITE M	93-76-5	2,4,5-T	mg/kg	1 : 1 : 9	1.80E-03	1.80E-03	No	ND	..	No	6.10E+02	No	No	<Tier I	No
SITE M	94-82-6	2,4-DB	mg/kg	2 : 9 : 9	1.72E-02	5.20E-02	No	ND	..	No	4.90E+02	No	No	<Tier I	No
SITE M	78-93-3	2-Butanone (MEK)	mg/kg	9 : 9 : 9	5.01E-02	1.00E-01	No	4.99E-02	Yes	No	7.30E+03	No	No	<Tier I	No

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Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC) Concentration	Is Max>DC?	COPC?	Reason	Is Avg>100x DC?
SITE M	72-55-9	4,4'-DDE	mg/kg	1 : 7 : 9	1.67E-02	3.50E-02	No	ND	--	No	2.00E+00	No	No	<Tier I	No
SITE M	50-29-3	4,4'-DDT	mg/kg	5 : 9 : 9	2.17E-01	1.30E+00	No	ND	--	No	2.00E+00	No	No	<Tier I	No
SITE M	106-47-8	4-Chloroaniline	mg/kg	1 : 1 : 9	1.00E-01	1.00E-01	No	ND	--	No	3.10E+02	No	No	<Tier I	No
SITE M	83-32-9	Acenaphthene	mg/kg	2 : 2 : 9	6.25E-02	8.60E-02	No	ND	--	No	4.70E+03	No	No	<Tier I	No
SITE M	67-64-1	Acetone	mg/kg	8 : 9 : 9	2.07E-01	5.65E-01	No	1.56E-01	Yes	No	7.80E+03	No	No	<Tier I	No
SITE M	319-84-6	alpha-BHC	mg/kg	1 : 5 : 9	1.48E-03	2.30E-03	No	ND	--	No	1.00E-01	No	No	<Tier I	No
SITE M	7429-90-5	Aluminum	mg/kg	9 : 9 : 9	3.87E+03	7.50E+03	No	2.90E+04	No	Yes	7.60E+04	No	No	<Tier I	No
SITE M	120-12-7	Anthracene	mg/kg	2 : 6 : 9	1.24E-01	2.30E-01	No	ND	--	No	2.30E+04	No	No	<Tier I	No
SITE M	7440-36-0	Antimony	mg/kg	5 : 9 : 9	2.91E+00	6.80E+00	No	2.75E+00	Yes	No	3.10E+01	No	No	<Tier I	No
SITE M	7440-38-2	Arsenic	mg/kg	9 : 9 : 9	7.28E+00	2.50E+01	No	1.44E+01	Yes	No	4.00E-01	Yes	Yes	>Tier I	No
SITE M	7440-39-3	Barium	mg/kg	9 : 9 : 9	4.51E-02	1.80E-03	No	4.13E+02	Yes	No	5.50E+03	No	No	<Tier I	No
SITE M	71-43-2	Benzene	mg/kg	4 : 9 : 9	8.35E-03	3.70E-02	No	ND	--	No	8.00E-01	No	No	<Tier I	No
SITE M	56-55-3	Benzo(a)anthracene	mg/kg	8 : 9 : 9	2.64E-01	7.20E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
SITE M	50-32-8	Benzo(a)pyrene	mg/kg	5 : 8 : 9	2.14E-01	4.80E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
SITE M	205-99-2	Benzo(b)fluoranthene	mg/kg	5 : 7 : 9	2.37E-01	6.10E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
SITE M	191-24-2	Benzo(g,h,i)perylene	mg/kg	5 : 6 : 9	1.69E-01	4.10E-01	No	ND	--	No	2.30E+03	No	No	<Tier I	No
SITE M	207-08-9	Benzo(k)fluoranthene	mg/kg	4 : 6 : 9	1.29E-01	3.40E-01	No	ND	--	No	9.00E+00	No	No	<Tier I	No
SITE M	7440-41-7	Beryllium	mg/kg	9 : 9 : 9	2.94E-01	5.50E-01	No	1.56E+00	No	Yes	1.56E+02	No	No	<Tier I	No
SITE M	117-81-7	Bis(2-ethylhexyl)phthalate	mg/kg	4 : 9 : 9	4.78E-01	1.13E+00	No	ND	--	No	4.60E+01	No	No	<Tier I	No
SITE M	7440-43-9	Cadmium	mg/kg	9 : 9 : 9	4.92E+00	1.70E+01	No	8.30E-01	Yes	No	7.80E+01	No	No	<Tier I	No
SITE M	7440-70-2	Calcium	mg/kg	9 : 9 : 9	7.54E+03	1.60E+04	Yes	2.70E+04	No	Yes	NA	No	No	EN	--
SITE M	86-74-8	Carbazole	mg/kg	1 : 1 : 9	3.20E-02	3.20E-02	No	ND	--	No	3.20E+01	No	No	<Tier I	No
SITE M	75-15-0	Carbon disulfide	mg/kg	8 : 9 : 9	2.34E-02	7.95E-02	No	ND	--	No	7.20E+02	No	No	<Tier I	No
SITE M	108-90-7	Chlorobenzene	mg/kg	8 : 9 : 9	3.38E-01	1.20E+00	No	ND	--	No	1.30E+02	No	No	<Tier I	No
SITE M	7440-47-3	Chromium	mg/kg	9 : 9 : 9	1.85E+01	5.50E+01	No	4.00E+01	Yes	No	2.70E+02	No	No	<Tier I	No
SITE M	218-01-9	Chrysene	mg/kg	8 : 9 : 9	2.99E-01	8.15E-01	No	ND	--	No	8.80E+01	No	No	<Tier I	No
SITE M	7440-48-4	Cobalt	mg/kg	9 : 9 : 9	8.24E+00	2.35E+01	No	1.72E+01	Yes	No	4.70E+03	No	No	<Tier I	No
SITE M	7440-50-8	Copper	mg/kg	9 : 9 : 9	1.44E+03	4.90E+03	No	3.80E+01	Yes	No	2.90E+03	Yes	Yes	>Tier I	No
SITE M	57-12-5	Cyanide	mg/kg	2 : 9 : 9	6.96E-01	9.90E-01	No	ND	--	No	1.60E+03	No	No	<Tier I	No
SITE M	53-70-3	Dibenzo(a,h)anthracene	mg/kg	2 : 5 : 9	8.06E-02	1.50E-01	No	ND	--	No	9.00E-02	Yes	Yes	>Tier I	No
SITE M	132-64-9	Dibenzofuran	mg/kg	1 : 1 : 9	7.70E-02	7.70E-02	No	ND	--	No	2.90E+02	No	No	<Tier I	No
SITE M	1918-00-9	Dicamba	mg/kg	2 : 2 : 9	2.95E-03	3.30E-03	No	ND	--	No	1.80E+03	No	No	<Tier I	No
SITE M	120-36-5	Dichloroprop	mg/kg	1 : 1 : 9	2.40E-02	2.40E-02	No	ND	--	No	NA	No	No	<Tier I	--
SITE M	7421-93-4	Endrin aldehyde	mg/kg	6 : 9 : 9	1.16E-01	8.30E-01	No	ND	--	No	2.30E+01	No	No	<Tier I	No
SITE M	100-41-4	Ethylbenzene	mg/kg	4 : 9 : 9	4.93E-03	1.10E-02	No	ND	--	No	4.00E+02	No	No	<Tier I	No
SITE M	206-44-0	Fluoranthene	mg/kg	8 : 9 : 9	5.08E-01	1.70E+00	No	ND	--	No	3.10E+03	No	No	<Tier I	No
SITE M	86-73-7	Fluorene	mg/kg	3 : 6 : 9	1.73E-01	4.90E-01	No	ND	--	No	3.10E+03	No	No	<Tier I	No
SITE M	58-89-9	gamma-BHC (Lindane)	mg/kg	4 : 4 : 9	2.85E-03	4.40E-03	No	ND	--	No	5.00E-01	No	No	<Tier I	No
SITE M	76-44-8	Heptachlor	mg/kg	2 : 9 : 9	2.66E-02	1.60E-01	No	ND	--	No	1.00E-01	Yes	Yes	>Tier I	No
SITE M	1024-57-3	Heptachlor epoxide	mg/kg	3 : 9 : 9	1.08E-01	8.60E-01	No	ND	--	No	7.00E-02	Yes	Yes	>Tier I	No
SITE M	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	2 : 5 : 9	1.17E-01	1.70E-01	No	ND	--	No	9.00E-01	No	No	<Tier I	No
SITE M	7439-89-6	Iron	mg/kg	9 : 9 : 9	1.05E+04	1.80E+04	Yes	4.13E+04	No	Yes	NA	No	No	EN	--

TABLE D-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Area	CAS #	Constituent	Units	Frequency of Detection	Average Concentration (Avg)	Maximum Detected Concentration (Max)	Essential Nutrient (EN)?	Sediment Background (BK) Concentration	Is Max>BK?	Pass EN/BK ?	Taco Tier I Residential Direct Contact (DC)	Is Concentration Max>DC?	COPC?	Reason	Is Avg>100x DC?
SITE M	7439-92-1	Lead	mg/kg	9 : 9 : 9	9.23E+01	2.70E+02	No	4.38E+01	Yes	No	4.00E+02	No	No	<Tier I	No
SITE M	7439-95-4	Magnesium	mg/kg	9 : 9 : 9	3.28E+03	6.50E+03	Yes	1.03E+04	No	Yes	NA	No	No	EN	--
SITE M	7439-96-5	Manganese	mg/kg	9 : 9 : 9	1.22E+02	3.60E+02	No	1.42E+03	No	Yes	3.70E+03	No	No	<Tier I	No
SITE M	7085-19-0	MCPP	mg/kg	1 : 9 : 9	2.04E+00	7.80E+00	No	ND	--	No	6.10E+01	No	No	<Tier I	No
SITE M	7439-97-6	Mercury	mg/kg	9 : 9 : 9	1.26E-01	3.00E-01	No	9.60E-02	Yes	No	1.00E+01	No	No	<Tier I	No
SITE M	7439-98-7	Molybdenum	mg/kg	3 : 9 : 9	6.96E-01	3.15E+00	No	8.90E-01	Yes	No	3.90E+02	No	No	<Tier I	No
SITE M	86-30-6	N-Nitrosodiphenylamine	mg/kg	1 : 6 : 9	1.91E-01	6.00E-01	No	ND	--	No	1.30E+02	No	No	<Tier I	No
SITE M	91-20-3	Naphthalene	mg/kg	2 : 5 : 9	1.07E-01	1.60E-01	No	ND	--	No	3.10E+03	No	No	<Tier I	No
SITE M	7440-02-0	Nickel	mg/kg	9 : 9 : 9	4.80E+02	1.50E+03	No	4.28E+01	Yes	No	1.60E+03	No	No	<Tier I	No
SITE M	87-86-5	Pentachlorophenol	mg/kg	9 : 9 : 9	6.37E-02	2.90E-01	No	7.52E-01	No	Yes	3.00E+00	No	No	<Tier I	No
SITE M	85-01-8	Phenanthrene	mg/kg	7 : 9 : 9	4.16E-01	1.40E+00	No	ND	--	No	2.30E+04	No	No	<Tier I	No
SITE M	7440-09-7	Potassium	mg/kg	9 : 9 : 9	8.13E+02	1.50E+03	Yes	4.20E+03	No	Yes	NA	No	No	EN	--
SITE M	129-00-0	Pyrene	mg/kg	3 : 9 : 9	6.36E-01	1.70E+00	No	ND	--	No	2.30E+03	No	No	<Tier I	No
SITE M	7440-22-4	Silver	mg/kg	7 : 9 : 9	1.67E+00	5.60E+00	No	ND	--	No	3.90E+02	No	No	<Tier I	No
SITE M	7440-23-5	Sodium	mg/kg	8 : 9 : 9	1.22E+02	2.60E+02	Yes	ND	--	Yes	NA	No	No	EN	--
SITE M	7440-31-5	Tin	mg/kg	4 : 9 : 9	7.33E+00	2.00E+01	No	ND	--	No	4.70E+04	No	No	<Tier I	No
SITE M	108-88-3	Toluene	mg/kg	8 : 9 : 9	1.01E-02	4.20E-02	No	ND	--	No	6.50E+02	No	No	<Tier I	No
SITE M	1336-36-3	Total PCBs	mg/kg	9 : 9 : 9	5.40E+00	2.71E+01	No	ND	--	No	1.00E+00	Yes	Yes	>Tier I	No
SITE M	7440-62-2	Vanadium	mg/kg	9 : 9 : 9	1.32E+01	2.30E+01	No	6.98E+01	No	Yes	5.50E+02	No	No	<Tier I	No
SITE M	1330-20-7	Xylenes (total)	mg/kg	5 : 9 : 9	4.40E-02	1.60E-01	No	ND	--	No	4.10E+02	No	No	<Tier I	No
SITE M	7440-66-6	Zinc	mg/kg	9 : 9 : 9	3.09E+03	1.20E+04	No	1.66E+02	Yes	No	2.30E+04	No	No	<Tier I	No

Attachment E

Absorption Adjustment Factors (AAFs) for bis(2-ethylhexyl)phthalate

BIS(2-ETHYLHEXYL)PHTHALATE (BEHP)

The U.S. EPA oral CSF for BEHP ($1.4E-02 \text{ (mg/kg-day)}^{-1}$) is based on a dietary study in mice, and the U.S. EPA oral RfD ($2E-02 \text{ mg/kg-day}$) is based on a dietary study in guinea pigs. Several studies indicate that gastrointestinal absorption of BEHP is high (Williams and Blanchfield, 1974; Schulz and Rubin, 1973; Pollack et al., 1985). ENSR assumes that absorption from diet or corn oil gavage is 100%. ENSR also assumes that the gastrointestinal absorption of BEHP from diet, drinking water, corn oil gavage, and ingestion of soil is the same. Thus, the AAF (oral-water), the AAF (oral-soil/sediment), and the AAF (oral-diet) are all 1.0 for both carcinogenic and noncarcinogenic effects.

Dermal absorption of BEHP was studied by Scott et al. (1987). The absorption of BEHP was measured in vitro through human and rat skin. Absorption rates were determined after an observable lag time. For human skin the lag time was 3.1 hours. The steady state absorption rate was found to be $1.1 \text{ ug/cm}^2/\text{hr}$ for human skin. As a fraction of the total dose, the amount of absorption observed over eight hours was 0.008%. Rat skin was found to be more permeable to BEHP, with an absorption rate of $2.2 \text{ ug/cm}^2/\text{hr}$.

Elsisi et al. (1989) also studied the dermal absorption of BEHP in rats in vivo. They dosed the animals dermally and used urinary and fecal excretion as an index of absorption. This method is valid, because phthalate esters are rapidly excreted from the body and are not bioaccumulated. For BEHP, 0.4% of the dose was found in the urine or the feces after 24 hours. The absorption efficiency of BEHP on soil after a six hour exposure is expected to be less than this amount. To be protective of human health, however, the value for absorption of pure BEHP after 24 hours in the rat will be used for AAF derivation. Thus, the dermal AAF for BEHP in soil relative to dietary administration is $0.4\%/100\% = 0.004$.

The AAF (dermal-water) is used when estimating the human risks posed by dermally contacting surface water when wading or swimming. The methodology for quantitating risks posed by this exposure pathway uses a chemical-specific permeability constant that estimates the rate at which the chemical passes into and through the skin from an aqueous solution. By definition, the dose estimated by this procedure is an absorbed dose. Most dose-response criteria, however, are based on administered doses. An adjustment is necessary to account for the absorption in the dose-response study. In order to use consistent dose-response criteria across all exposure pathways, the AAF is used to make an adjustment to the absorbed dermal dose, instead of adjusting the dose-response criteria. Here, the AAF is defined as (100%)/(estimated absorption in the dose-response study). For BEHP, the AAF (dermal-water) is (100%)/(100%) = 1.0.

Summary of AAFs for BEHP (for both carcinogenic and noncarcinogenic effects)

Oral-water	1.0
Oral-diet	1.0
Oral-soil	1.0
Dermal-soil	0.004
Dermal-water	1.0

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Attachment F

Risk Calculation Spreadsheets

SAUGET AREA 1 - CREEK BOTTOM SOILS
RME

Receptors Evaluated	
Receptor 1:	RME Recreational Teen

ASSUMPTIONS FOR RECREATIONAL TEEN - RME
INCIDENTAL INGESTION AND DERMAL CONTACT CREEK BOTTOM SOILS

	Assumed Value	Calculated Value
Soil Ingestion Rate	100	(mg soil/day)
Soil on Skin	1	(mg/cm ²)
Skin Exposed	2029	(cm ²)
Body Weight	47	(kg)
Exposure Frequency	26	(days)/365(days) = 7.12E-02
Exposure Duration (cancer)	11	(years)/70(years) = 1.57E-01
Exposure Duration (noncancer)	11	(yrs)/11(yrs) = 1.00E+00
Lifetime	70	(years)
Unit Conversion Factor	1.00E-06	(kg/mg)

17-Jun-02

SAUGET AREA 1 - CREEK BOTTOM SOILS

RME

POTENTIAL CARCINOGENIC RISK
INCIDENTIAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
RECREATIONAL TEEN - RME

Constituent	Unit in Soil (mg/kg)	Concentration in Soil (mg/kg)	Unit Oral - Soil Absorption Factor	Oral - Soil Absorption Factor	Unit Dermal - Soil Absorption Factor	Oral Cancer Slope Factor (mg/kg-day) ¹	Lifetime Average Daily Dose-Ing. (mg/kg-day)	Lifetime Average Daily Dose-Der. (mg/kg-day)	Lifetime Excess Lifetime Cancer Risk - Ingestion	Lifetime Excess Lifetime Cancer Risk - Dermal Contact	Unit Cancer Risk
1,4-Dichlorobenzene	1.00E+00	1.00E+00	1	0.01	2.40E-02	2.38E-08	4.83E-09	5.72E-10	1.16E-10	6.88E-10	
4-Nitroaniline	1.00E+00	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	1.00E+00	0.3	0.001	1.50E+00	7.14E-09	4.83E-10	1.07E-08	7.25E-10	1.14E-08	
Benzo(a)anthracene	1.00E+00	1.00E+00	0.29	0.02	7.30E-01	6.91E-09	9.66E-09	5.04E-09	7.06E-09	1.21E-08	
Benzo(a)pyrene	1.00E+00	1.00E+00	0.29	0.02	7.30E+00	6.91E-09	9.66E-09	5.04E-08	7.06E-08	1.21E-07	
Benzo(b)fluoranthene	1.00E+00	1.00E+00	0.29	0.02	7.30E-01	6.91E-09	9.66E-09	5.04E-09	7.06E-09	1.21E-08	
Bis(2-ethylhexyl)phthalate	1.00E+00	1.00E+00	1	0.004	1.40E-02	2.38E-08	1.93E-09	3.33E-10	2.71E-11	3.60E-10	
Copper	1.00E+00	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Dibenzo(a,h)anthracene	1.00E+00	1.00E+00	0.29	0.02	7.30E+00	6.91E-09	9.66E-09	5.04E-08	7.06E-08	1.21E-07	
Heptachlor	1.00E+00	1.00E+00	1	0.01	4.50E+00	2.38E-08	4.83E-09	3.81E-07	7.73E-08	4.58E-07	
Heptachlor epoxide	1.00E+00	1.00E+00	1	0.01	9.10E+00	2.38E-08	4.83E-09	2.17E-07	4.40E-08	2.61E-07	
Lead	1.00E+00	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1.00E+00	1	0.01	1.20E-01	2.38E-08	4.83E-09	2.86E-09	5.80E-10	3.44E-09	
2,3,7,8-TCDD TEQ	1.00E+00	1.00E+00	0.5	0.05	1.50E+05	1.19E-08	2.42E-08	1.79E-03	3.62E-03	5.41E-03	
Total PCBs	1.00E+00	1.00E+00	0.83	0.04	2.00E+00	1.98E-08	1.93E-08	3.95E-08	3.87E-08	7.82E-08	

Carcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 RME Recreational Teen
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Compound	Reference Risk (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	Risk								
1,4-Dichlorobenzene	6.88E-10	0.27	1.88E-10	--	NC	--	NC	--	NC	4.10	2.82E-09
4-Nitroaniline	NC	0.74	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	1.14E-08	11.40	1.30E-07	18.00	2.06E-07	11.00	1.26E-07	11.37	1.30E-07	11.47	1.31E-07
Benzo(a)anthracene	1.21E-08	0.17	2.04E-09	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	1.21E-07	0.11	1.30E-08	0.14	1.69E-08	0.11	1.31E-08	0.08	9.65E-09	0.48	5.81E-08
Benzo(b)fluoranthene	1.21E-08	0.16	1.94E-09	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	3.60E-10	0.35	1.25E-10	--	NC	--	NC	--	NC	--	NC
Copper	NC	1114.53	NC	--	NC	1088.14	NC	--	NC	4900.00	NC
Dibenz(a,h)anthracene	1.21E-07	0.08	9.23E-09	--	NC	0.08	9.16E-09	--	NC	0.15	1.81E-08
Dieldrin	4.58E-07	0.009	4.10E-09	0.69	3.16E-07	--	NC	--	NC	--	NC
Heptachlor	1.29E-07	--	NC	--	NC	--	NC	--	NC	0.10	1.29E-08
Heptachlor epoxide	2.61E-07	0.01	3.18E-09	--	NC	--	NC	--	NC	0.86	2.24E-07
Lead	NC	122.58	NC	--	NC	--	NC	85.10	NC	--	NC
Pentachlorophenol	3.44E-09	0.26	9.10E-10	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	5.41E-03	0.00031	1.65E-06	--	NC	--	NC	--	NC	0.0051	2.76E-05
Total PCBs	7.82E-08	1.74	1.36E-07	2.44	1.91E-07	0.27	2.11E-08	--	NC	24.76	1.94E-06
TOTAL			1.95E-06		7.30E-07		1.69E-07		1.40E-07		3.00E-05

Notes:

EPC - Exposure Point Concentration.

NC - Not Calculated.

-- Not a Compound of Potential Concern in this medium.

(a) - Reference risk is multiplied by the EPC in each area to obtain the potential risk.

SAUGET AREA 1 - CREEK BOTTOM SOILS

RME

NONCARCINOGENIC HAZARD INDEX

INCIDENTIAL INGESTION AND DERMAL CONTACT

CREEK BOTTOM SOILS

RECREATIONAL TEEN - RME

Constituent	Unit Concentration in Soil (mg/kg)	Oral - Soil Absorption Factor	Dermal - Soil Absorption Factor	Reference Dose (mg/kg-day)	Chronic Average Daily Dose-Ing. (mg/kg-day)	Chronic Average Daily Dose-Der. (mg/kg-day)	Hazard Index - Ingestion	Hazard Index - Dermal	Unit Hazard Index
1,4-Dichlorobenzene	1.00E+00	1	0.01	3.00E-02	1.52E-07	3.08E-08	5.05E-06	1.03E-06	6.08E-06
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	3.00E-04	4.55E-08	3.08E-09	1.52E-04	1.03E-05	1.62E-04
Benzo(a)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(a)pyrene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(b)fluoranthene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	2.00E-02	1.52E-07	1.23E-08	7.58E-06	6.15E-07	8.19E-06
Copper	1.00E+00	1	0.002	3.70E-02	1.52E-07	6.15E-09	4.10E-06	1.66E-07	4.26E-06
Dibenzo(a,h)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dieldrin	1.00E+00	1	0.01	5.00E-05	1.52E-07	3.08E-08	3.03E-03	6.15E-04	3.65E-03
Heptachlor	1.00E+00	1	0.01	5.00E-04	1.52E-07	3.08E-08	3.03E-04	6.15E-05	3.65E-04
Heptachlor epoxide	1.00E+00	1	0.01	1.30E-05	1.52E-07	3.08E-08	1.17E-02	2.37E-03	1.40E-02
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	3.00E-02	1.52E-07	3.08E-08	5.05E-06	1.03E-06	6.08E-06
2,3,7,8-TCDD TEQ	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Total PCBs	1.00E+00	0.83	0.04	2.00E-05	1.26E-07	1.23E-07	6.29E-03	6.15E-03	1.24E-02

Noncarcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 RME Recreational Teen
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Compound	Reference HQ (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSP		SITE M	
		EPC (mg/kg)	HQ								
1,4-Dichlorobenzene	6.08E-06	0.27	1.66E-06	--	NC	--	NC	--	NC	4.10	2.49E-05
4-Nitroaniline	NC	0.74	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	1.62E-04	11.40	1.84E-03	18.00	2.91E-03	11.00	1.78E-03	11.37	1.84E-03	11.47	1.86E-03
Benzo(a)anthracene	NC	0.17	NC	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	NC	0.11	NC	0.14	NC	0.11	NC	0.08	NC	0.48	NC
Benzo(b)fluoranthene	NC	0.16	NC	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	8.19E-06	0.35	2.83E-06	--	NC	--	NC	--	NC	--	NC
Copper	4.26E-06	1114.53	4.75E-03	--	NC	1088.14	4.64E-03	--	NC	4900.00	2.09E-02
Dibenz(a,h)anthracene	NC	0.08	NC	--	NC	0.08	NC	--	NC	0.15	NC
Dieldrin	3.65E-03	0.009	3.26E-05	0.69	2.52E-03	--	NC	--	NC	--	NC
Heptachlor	3.65E-04	--	NC	--	NC	--	NC	--	NC	0.10	3.65E-05
Heptachlor epoxide	1.40E-02	0.01	1.71E-04	--	NC	--	NC	--	NC	0.86	1.21E-02
Lead	NC	122.58	NC	--	NC	--	NC	85.10	NC	--	NC
Pentachlorophenol	6.08E-06	0.26	1.61E-06	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	NC	0.00031	NC	--	NC	--	NC	--	NC	0.0051	NC
Total PCBs	1.24E-02	1.74	2.16E-02	2.44	3.03E-02	0.27	3.36E-03	--	NC	24.76	3.08E-01
TOTAL			2.84E-02		3.58E-02		9.78E-03		1.84E-03		3.43E-01

Notes:

EPC - Exposure Point Concentration.

HQ - Hazard Quotient.

NC - Not Calculated.

-- Not a Compound of Potential Concern in this medium.

(a) - Reference HQ is multiplied by the EPC in each area to obtain the area HQ.

SAUGET AREA 1 - CREEK BOTTOM SOILS
MLE

Receptors Evaluated

Receptor 1:	MLE Recreational Teen
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ASSUMPTIONS FOR RECREATIONAL TEEN - MLE
INCIDENTAL INGESTION AND DERMAL CONTACT CREEK BOTTOM SOILS

		Assumed Value	Calculated Value
Soil Ingestion Rate	MLE Recreational Teen	50	(mg soil/day)
Soil on Skin	MLE Recreational Teen	1	(mg/cm ²)
Skin Exposed	MLE Recreational Teen	2029	(cm ²)
Body Weight	MLE Recreational Teen	47	(kg)
Exposure Frequency	MLE Recreational Teen	13	(days)/365(days) = 3.56E-02
Exposure Duration (cancer)	MLE Recreational Teen	11	(years)/70(years) = 1.57E-01
Exposure Duration (noncancer)	MLE Recreational Teen	11	(yrs)/11(yrs) = 1.00E+00
Lifetime		70	(years)
Unit Conversion Factor		1.00E-06	(kg/mg)

17-Jun-02

SAUGET AREA 1 - CREEK BOTTOM SOILS

MLE

POTENTIAL CARCINOGENIC RISK
INCIDENTIAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
RECREATIONAL TEEN - MLE

Constituent	Unit	Oral - Soil	Dermal - Soil	Oral	Lifetime	Lifetime	Excess Lifetime	Excess Lifetime	Unit
	Concentration in Soil (mg/kg)	Absorption Adjustment Factor	Absorption Adjustment Factor	Cancer Slope Factor (mg/kg-day) [*]	Average Daily Dose-Ing. (mg/kg-day)	Average Daily Dose-Der. (mg/kg-day)	Cancer Risk - Ingestion	Cancer Risk - Dermal Contact	Cancer Risk
1,4-Dichlorobenzene	1.00E+00	1	0.01	2.40E-02	5.95E-09	2.42E-09	1.43E-10	5.80E-11	2.01E-10
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	1.50E+00	1.79E-09	2.42E-10	2.68E-09	3.62E-10	3.04E-09
Benzo(a)anthracene	1.00E+00	0.29	0.02	7.30E-01	1.73E-09	4.83E-09	1.26E-09	3.53E-09	4.79E-09
Benzo(a)pyrene	1.00E+00	0.29	0.02	7.30E+00	1.73E-09	4.83E-09	1.26E-08	3.53E-08	4.79E-08
Benzo(b)fluoranthene	1.00E+00	0.29	0.02	7.30E-01	1.73E-09	4.83E-09	1.26E-09	3.53E-09	4.79E-09
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	1.40E-02	5.95E-09	9.66E-10	8.34E-11	1.35E-11	9.69E-11
Copper	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dibenzo(a,h)anthracene	1.00E+00	0.29	0.02	7.30E+00	1.73E-09	4.83E-09	1.26E-08	3.53E-08	4.79E-08
Dieldrin	1.00E+00	1	0.01	1.60E+01	5.95E-09	2.42E-09	9.53E-08	3.87E-08	1.34E-07
Heptachlor	1.00E+00	1	0.01	4.50E+00	5.95E-09	2.42E-09	2.68E-08	1.09E-08	3.77E-08
Heptachlor epoxide	1.00E+00	1	0.01	9.10E+00	5.95E-09	2.42E-09	5.42E-08	2.20E-08	7.62E-08
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	1.20E-01	5.95E-09	2.42E-09	7.14E-10	2.90E-10	1.00E-09
2,3,7,8-TCDD TEQ	1.00E+00	0.5	0.05	1.50E+05	2.98E-09	1.21E-08	4.47E-04	1.81E-03	2.26E-03
Total PCBs	1.00E+00	0.83	0.04	2.00E+00	4.94E-09	9.66E-09	9.88E-09	1.93E-08	2.92E-08

Carcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 MLE Recreational Teen
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Compound	Reference Risk (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	Risk								
1,4-Dichlorobenzene	2.01E-10	0.29	5.89E-11	--	NC	--	NC	--	NC	0.98	1.97E-10
4-Nitroaniline	NC	0.76	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	3.04E-09	9.72	2.96E-08	11.40	3.47E-08	8.08	2.46E-08	9.71	2.95E-08	7.28	2.21E-08
Benzo(a)anthracene	4.79E-09	0.17	8.11E-10	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	4.79E-08	0.11	5.21E-09	0.08	4.06E-09	0.09	4.29E-09	0.07	3.33E-09	0.21	1.01E-08
Benzo(b)fluoranthene	4.79E-09	0.16	7.45E-10	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	9.69E-11	1.77	1.71E-10	--	NC	--	NC	--	NC	--	NC
Copper	NC	484.20	NC	--	NC	425.21	NC	--	NC	1437.78	NC
Dibenz(a,h)anthracene	4.79E-08	0.07	3.45E-09	--	NC	0.07	3.32E-09	--	NC	0.08	3.88E-09
Dieldrin	1.34E-07	0.008	1.03E-09	0.13	1.71E-08	--	NC	--	NC	--	NC
Heptachlor	3.77E-08	--	NC	--	NC	--	NC	--	NC	0.03	1.02E-09
Heptachlor epoxide	7.62E-08	0.01	1.09E-09	--	NC	--	NC	--	NC	0.11	8.38E-09
Lead	NC	74.61	NC	--	NC	--	NC	--	NC	--	NC
Pentachlorophenol	1.00E-09	0.99	9.92E-10	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	2.26E-03	0.00024	5.46E-07	--	NC	--	NC	--	NC	0.00100	2.26E-06
Total PCBs	2.92E-08	2.78	8.11E-08	0.49	1.44E-08	0.19	5.46E-09	--	NC	5.40	1.58E-07
TOTAL			6.70E-07		7.02E-08		3.77E-08		3.29E-08		2.46E-06

Notes:
 EPC - Exposure Point Concentration.
 NC - Not Calculated.
 -- Not a Compound of Potential Concern in this medium.
 (a) - Reference risk is multiplied by the EPC in each area to obtain the potential risk.

SAUGET AREA 1 - CREEK BOTTOM SOILS

MLE

NONCARCINOGENIC HAZARD INDEX

INCIDENTAL INGESTION AND DERMAL CONTACT

CREEK BOTTOM SOILS

RECREATIONAL TEEN - MLE

Constituent	Unit in Soil (mg/kg)	Oral - Soil Absorption Factor	Dermal - Soil Absorption Factor	Oral Reference Dose (mg/kg-day)	Chronic Average Daily Dose-Ing. (mg/kg-day)	Chronic Average Daily Dose-Der. (mg/kg-day)	Hazard Index - Ingestion	Hazard Index - Dermal Contact	Unit Hazard Index
1,4-Dichlorobenzene	1.00E+00	1	0.01	3.00E-02	3.79E-08	1.54E-08	1.26E-06	5.13E-07	1.78E-06
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	3.00E-04	1.14E-08	1.54E-09	3.79E-05	5.13E-06	4.30E-05
Benzo(a)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(a)pyrene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(b)fluoranthene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	2.00E-02	3.79E-08	6.15E-09	1.89E-06	3.08E-07	2.20E-06
Copper	1.00E+00	1	0.002	3.70E-02	3.79E-08	3.08E-09	1.02E-06	8.31E-08	1.11E-06
Dibenzo(a,h)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dieldrin	1.00E+00	1	0.01	5.00E-05	3.79E-08	1.54E-08	7.58E-04	3.08E-04	1.07E-03
Heptachlor	1.00E+00	1	0.01	5.00E-04	3.79E-08	1.54E-08	7.58E-05	3.08E-05	1.07E-04
Heptachlor epoxide	1.00E+00	1	0.01	1.30E-05	3.79E-08	1.54E-08	2.91E-03	1.18E-03	4.10E-03
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	3.00E-02	3.79E-08	1.54E-08	1.26E-06	5.13E-07	1.78E-06
2,3,7,8-TCDD TEQ	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Total PCBs	1.00E+00	0.83	0.04	2.00E-05	3.14E-08	6.15E-08	1.57E-03	3.08E-03	4.65E-03

Noncarcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 MLE Recreational Teen
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Compound	Reference HQ (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	HQ								
1,4-Dichlorobenzene	1.78E-06	0.29	5.20E-07	--	NC	--	NC	--	NC	0.98	1.74E-06
4-Nitroaniline	NC	0.76	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	4.30E-05	9.72	4.18E-04	11.40	4.90E-04	8.06	3.48E-04	9.71	4.18E-04	7.28	3.13E-04
Benzo(a)anthracene	NC	0.17	NC	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	NC	0.11	NC	0.08	NC	0.09	NC	0.07	NC	0.21	NC
Benzo(b)fluoranthene	NC	0.16	NC	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	2.20E-06	1.77	3.89E-06	--	NC	--	NC	--	NC	--	NC
Copper	1.11E-06	484.20	5.38E-04	--	NC	425.21	4.71E-04	--	NC	1437.78	1.59E-03
Dibenz(a,h)anthracene	NC	0.07	NC	--	NC	0.07	NC	--	NC	0.08	NC
Dieldrin	1.07E-03	0.01	8.22E-06	0.13	1.36E-04	--	NC	--	NC	--	NC
Heptachlor	1.07E-04	--	NC	--	NC	--	NC	--	NC	0.03	2.88E-06
Heptachlor epoxide	4.10E-03	0.01	5.85E-05	--	NC	--	NC	--	NC	0.11	4.51E-04
Lead	NC	74.61	NC	--	NC	--	NC	58.13	NC	--	NC
Pentachlorophenol	1.78E-06	0.99	1.75E-06	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	NC	0.00024	NC	--	NC	--	NC	--	NC	0.00100	NC
Total PCBs	4.65E-03	2.78	1.29E-02	0.49	2.28E-03	0.19	8.68E-04	--	NC	5.40	2.51E-02
TOTAL			1.39E-02		2.91E-03		1.69E-03		4.18E-04		2.75E-02

Notes:
 EPC - Exposure Point Concentration.
 HQ - Hazard Quotient.
 NC - Not Calculated.
 -- Not a Compound of Potential Concern in this medium.
 (a) - Reference HQ is multiplied by the EPC in each area to obtain the area HQ.

SAUGET AREA 1 - CREEK BOTTOM SOILS
RME

Receptors Evaluated

Receptor 1:	RME Construction Worker
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ASSUMPTIONS FOR CONSTRUCTION WORKER - RME INCIDENTIAL INGESTION AND DERMAL CONTACT CREEK BOTTOM SOILS		Assumed Value	Calculated Value
Soil Ingestion Rate	RME Construction Worker	100	(mg soil/day)
Soil on Skin	RME Construction Worker	1.00	(mg/cm ²)
Skin Exposed	RME Construction Worker	3339	(cm ²)
Body Weight	RME Construction Worker	70	(kg)
Exposure Frequency	RME Construction Worker	40	(days)/365(days) = 1.10E-01
Exposure Duration (cancer)	RME Construction Worker	1	(years)/70(years) = 1.43E-02
Exposure Duration (noncancer)	RME Construction Worker	1	(yrs)/1(yrs) = 1.00E+00
Lifetime		70	(years)
Unit Conversion Factor		1.00E-06	(kg/mg)

17-Jun-02

SAUGET AREA 1 - CREEK BOTTOM SOILS

RME

POTENTIAL CARCINOGENIC RISK
INCIDENTIAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
CONSTRUCTION WORKER - RME

Constituent	Unit	Oral - Soil	Dermal - Soil	Oral	Lifetime	Lifetime	Excess Lifetime Cancer Risk - Ingestion	Excess Lifetime Cancer Risk - Dermal Contact	Unit Cancer Risk
	Concentration in Soil (mg/kg)	Absorption Adjustment Factor	Absorption Adjustment Factor	Cancer Slope Factor (mg/kg-day)	Average Daily Dose-Ing. (mg/kg-day)	Average Daily Dose-Der. (mg/kg-day)			
1,4-Dichlorobenzene	1.00E+00	1	0.01	2.40E-02	2.24E-09	7.47E-10	5.37E-11	1.79E-11	7.16E-11
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	1.50E+00	6.71E-10	7.47E-11	1.01E-09	1.12E-10	1.12E-09
Benzo(a)anthracene	1.00E+00	0.29	0.02	7.30E-01	6.49E-10	1.49E-09	4.73E-10	1.09E-09	1.56E-09
Benzo(a)pyrene	1.00E+00	0.29	0.02	7.30E+00	6.49E-10	1.49E-09	4.73E-09	1.09E-08	1.56E-08
Benzo(b)fluoranthene	1.00E+00	0.29	0.02	7.30E-01	6.49E-10	1.49E-09	4.73E-10	1.09E-09	1.56E-09
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	1.40E-02	2.24E-09	2.99E-10	3.13E-11	4.18E-12	3.55E-11
Copper	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dibenzo(a,h)anthracene	1.00E+00	0.29	0.02	7.30E+00	6.49E-10	1.49E-09	4.73E-09	1.09E-08	1.56E-08
Dieldrin	1.00E+00	1	0.01	1.60E+01	2.24E-09	7.47E-10	3.58E-08	1.19E-08	4.77E-08
Heptachlor	1.00E+00	1	0.01	4.50E+00	2.24E-09	7.47E-10	1.01E-08	3.36E-09	1.34E-08
Heptachlor epoxide	1.00E+00	1	0.01	9.10E+00	2.24E-09	7.47E-10	2.04E-08	6.80E-09	2.71E-08
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	1.20E-01	2.24E-09	7.47E-10	2.68E-10	8.96E-11	3.58E-10
2,3,7,8-TCDD TEQ	1.00E+00	0.5	0.05	1.50E+05	1.12E-09	3.73E-09	1.68E-04	5.60E-04	7.28E-04
Total PCBs	1.00E+00	0.83	0.04	2.00E+00	1.86E-09	2.99E-09	3.71E-09	5.97E-09	9.69E-09

Carcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 RME Construction Worker
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Compound	Reference Risk (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	Risk								
1,4-Dichlorobenzene	7.16E-11	0.27	1.96E-11	--	NC	--	NC	--	NC	4.10	2.94E-10
4-Nitroaniline	NC	0.74	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	1.12E-09	11.40	1.27E-08	18.00	2.01E-08	11.00	1.23E-08	11.37	1.27E-08	11.47	1.28E-08
Benzo(a)anthracene	1.56E-09	0.17	2.64E-10	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	1.56E-08	0.11	1.68E-09	0.14	2.19E-09	0.11	1.69E-09	0.08	1.25E-09	0.48	7.51E-09
Benzo(b)fluoranthene	1.56E-09	0.16	2.51E-10	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	3.55E-11	0.35	1.23E-11	--	NC	--	NC	--	NC	--	NC
Copper	NC	1114.53	NC	--	NC	1088.14	NC	--	NC	4900.00	NC
Dibenzo(a,h)anthracene	1.56E-08	0.08	1.19E-09	--	NC	0.08	1.18E-09	--	NC	0.15	2.35E-09
Dieldrin	4.77E-08	0.009	4.27E-10	0.69	3.29E-08	--	NC	--	NC	--	NC
Heptachlor	1.34E-08	--	NC	--	NC	--	NC	--	NC	0.10	1.34E-09
Heptachlor epoxide	2.71E-08	0.01	3.31E-10	--	NC	--	NC	--	NC	0.86	2.33E-08
Lead	NC	122.58	NC	--	NC	--	NC	85.10	NC	--	NC
Pentachlorophenol	3.58E-10	0.26	9.48E-11	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	7.28E-04	0.00031	2.22E-07	--	NC	--	NC	--	NC	0.0051	3.71E-06
Total PCBs	9.69E-09	1.74	1.68E-08	2.44	2.36E-08	0.27	2.62E-09	--	NC	24.76	2.40E-07
TOTAL			2.56E-07		7.89E-08		1.78E-08		1.40E-08		4.00E-06

Notes:

EPC - Exposure Point Concentration.

NC - Not Calculated.

-- - Not a Compound of Potential Concern in this medium.

(a) - Reference risk is multiplied by the EPC in each area to obtain the potential risk.

SAUGET AREA 1 - CREEK BOTTOM SOILS

RME

NONCARCINOGENIC HAZARD INDEX
INCIDENTIAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
CONSTRUCTION WORKER - RME

Constituent	Unit Concentration in Soil (mg/kg)	Oral - Soil Absorption Factor	Dermal - Soil Absorption Factor	Oral Reference Dose (mg/kg-day)	Chronic Average Daily Dose-Ing. (mg/kg-day)	Chronic Average Daily Dose-Der. (mg/kg-day)	Hazard Index - Ingestion	Hazard Index - Dermal Contact	Unit Hazard Index
1,4-Dichlorobenzene	1.00E+00	1	0.01	3.00E-02	1.57E-07	5.23E-08	5.22E-06	1.74E-06	6.96E-06
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	3.00E-04	4.70E-08	5.23E-09	1.57E-04	1.74E-05	1.74E-04
Benzo(a)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(a)pyrene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(b)fluoranthene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	2.00E-02	1.57E-07	2.09E-08	7.83E-06	1.05E-06	8.87E-06
Copper	1.00E+00	1	0.002	3.70E-02	1.57E-07	1.05E-08	4.23E-06	2.83E-07	4.51E-06
Dibenzo(a,h)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dieledrin	1.00E+00	1	0.01	5.00E-05	1.57E-07	5.23E-08	3.13E-03	1.05E-03	4.18E-03
Heptachlor	1.00E+00	1	0.01	5.00E-04	1.57E-07	5.23E-08	3.13E-04	1.05E-04	4.18E-04
Heptachlor epoxide	1.00E+00	1	0.01	1.30E-05	1.57E-07	5.23E-08	1.20E-02	4.02E-03	1.61E-02
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	3.00E-02	1.57E-07	5.23E-08	5.22E-06	1.74E-06	6.96E-06
2,3,7,8-TCDD TEQ	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Total PCBs	1.00E+00	0.83	0.04	2.00E-05	1.30E-07	2.09E-07	6.50E-03	1.05E-02	1.70E-02

Noncarcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 RME Construction Worker
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Compound	Reference HQ (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	HQ								
1,4-Dichlorobenzene	6.96E-06	0.27	1.90E-06	--	NC	--	NC	--	NC	4.10	2.85E-05
4-Nitroaniline	NC	0.74	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	1.74E-04	11.40	1.98E-03	18.00	3.13E-03	11.00	1.91E-03	11.37	1.98E-03	11.47	2.00E-03
Benzo(a)anthracene	NC	0.17	NC	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	NC	0.11	NC	0.14	NC	0.11	NC	0.08	NC	0.48	NC
Benzo(b)fluoranthene	NC	0.16	NC	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	8.87E-06	0.35	3.07E-06	--	NC	--	NC	--	NC	--	NC
Copper	4.51E-06	1114.53	5.03E-03	--	NC	1088.14	4.91E-03	--	NC	4900.00	2.21E-02
Dibenzo(a,h)anthracene	NC	0.08	NC	--	NC	0.08	NC	--	NC	0.15	NC
Dieldrin	4.18E-03	0.009	3.74E-05	0.69	2.88E-03	--	NC	--	NC	--	NC
Heptachlor	4.18E-04	--	NC	--	NC	--	NC	--	NC	0.10	4.18E-05
Heptachlor epoxide	1.61E-02	0.01	1.96E-04	--	NC	--	NC	--	NC	0.86	1.38E-02
Lead	NC	122.58	NC	--	NC	--	NC	85.10	NC	--	NC
Pentachlorophenol	6.96E-06	0.26	1.84E-06	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	NC	0.00031	NC	--	NC	--	NC	--	NC	0.0051	NC
Total PCBs	1.70E-02	1.74	2.94E-02	2.44	4.14E-02	0.27	4.58E-03	--	NC	24.76	4.20E-01
TOTAL			3.67E-02		4.74E-02		1.14E-02		1.98E-03		4.58E-01

Notes:
 EPC - Exposure Point Concentration.
 HQ - Hazard Quotient.
 NC - Not Calculated.
 -- - Not a Compound of Potential Concern in this medium.
 (a) - Reference HQ is multiplied by the EPC in each area to obtain the area HQ.

SAUGET AREA 1 - CREEK BOTTOM SOILS
MLE

Receptors Evaluated	
Receptor 1:	MLE Construction Worker

ASSUMPTIONS FOR CONSTRUCTION WORKER - MLE INCIDENTAL INGESTION AND DERMAL CONTACT CREEK BOTTOM SOILS		Assumed Value	Calculated Value
		Units	
Soil Ingestion Rate	MLE Construction Worker	64	(mg soil/day)
Soil on Skin	MLE Construction Worker	1.00	(mg/cm ²)
Skin Exposed	MLE Construction Worker	3339	(cm ²)
Body Weight	MLE Construction Worker	70	(kg)
Exposure Frequency	MLE Construction Worker	20	(days)/365(days) = 5.48E-02
Exposure Duration (cancer)	MLE Construction Worker	1	(years)/70(years) = 1.43E-02
Exposure Duration (noncancer)	MLE Construction Worker	1	(yrs)/1(yrs) = 1.00E+00
Lifetime		70	(years)
Unit Conversion Factor		1.00E-06	(kg/mg)

17-Jun-02

SAUGET AREA 1 - CREEK BOTTOM SOILS

MLE

POTENTIAL CARCINOGENIC RISK
INCIDENTAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
CONSTRUCTION WORKER - MLE

Constituent	Unit in Soil (mg/kg)	Oral - Soil Absorption Factor	Dermal - Soil Absorption Factor	Oral Cancer Slope Factor (mg/kg-day)	Lifetime Average Daily Dose-Ing. (mg/kg-day)	Lifetime Average Daily Dose-Der. (mg/kg-day)	Excess Lifetime Cancer Risk - Ingestion	Excess Lifetime Cancer Risk - Dermal Contact	Unit Cancer Risk
1,4-Dichlorobenzene	1.00E+00	1	0.01	2.40E-02	7.16E-10	3.73E-10	1.72E-11	8.96E-12	2.61E-11
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	1.50E+00	2.15E-10	3.73E-11	3.22E-10	5.60E-11	3.78E-10
Benzo(a)anthracene	1.00E+00	0.29	0.02	7.30E-01	2.08E-10	7.47E-10	1.52E-10	5.45E-10	6.97E-10
Benzo(a)pyrene	1.00E+00	0.29	0.02	7.30E+00	2.08E-10	7.47E-10	1.52E-09	5.45E-09	6.97E-09
Benzo(b)fluoranthene	1.00E+00	0.29	0.02	7.30E-01	2.08E-10	7.47E-10	1.52E-10	5.45E-10	6.97E-10
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	1.40E-02	7.16E-10	1.49E-10	1.00E-11	2.09E-12	1.21E-11
Copper	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Dibenz(a,h)anthracene	1.00E+00	0.29	0.02	7.30E+00	2.08E-10	7.47E-10	1.52E-09	5.45E-09	6.97E-09
Dieldrin	1.00E+00	1	0.01	1.60E+01	7.16E-10	3.73E-10	1.15E-08	5.97E-09	1.74E-08
Heptachlor	1.00E+00	1	0.01	4.50E+00	7.16E-10	3.73E-10	3.22E-09	1.68E-09	4.90E-09
Heptachlor epoxide	1.00E+00	1	0.01	9.10E+00	7.16E-10	3.73E-10	6.51E-09	3.40E-09	9.91E-09
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	1.20E-01	7.16E-10	3.73E-10	8.59E-11	4.48E-11	1.31E-10
2,3,7,8-TCDD TEQ	1.00E+00	0.5	0.05	1.50E+05	3.58E-10	1.87E-09	5.37E-05	2.80E-04	3.34E-04
Total PCBs	1.00E+00	0.83	0.04	2.00E+00	5.94E-10	1.49E-09	1.19E-09	2.99E-09	4.18E-09

Carcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 MLE Construction Worker
 SAUGET AREA 1 - CREEK BOTTOM SOILS
 HUMAN HEALTH RISK ASSESSMENT

Compound	Reference Risk (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	Risk								
1,4-Dichlorobenzene	2.61E-11	0.29	7.66E-12	--	NC	--	NC	--	NC	0.98	2.56E-11
4-Nitroaniline	NC	0.76	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	3.78E-10	9.72	3.67E-09	11.40	4.31E-09	8.08	3.06E-09	9.71	3.67E-09	7.28	2.75E-09
Benzo(a)anthracene	6.97E-10	0.17	1.18E-10	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	6.97E-09	0.11	7.59E-10	0.08	5.91E-10	0.09	6.25E-10	0.07	4.84E-10	0.21	1.46E-09
Benzo(b)fluoranthene	6.97E-10	0.16	1.08E-10	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	1.21E-11	1.77	2.14E-11	--	NC	--	NC	--	NC	--	NC
Copper	NC	484.20	NC	--	NC	425.21	NC	--	NC	1437.78	NC
Dibenzo(a,h)anthracene	6.97E-09	0.07	5.02E-10	--	NC	0.07	4.83E-10	--	NC	0.08	5.64E-10
Dieldrin	1.74E-08	0.008	1.34E-10	0.13	2.22E-09	--	NC	--	NC	--	NC
Heptachlor	4.90E-09	--	NC	--	NC	--	NC	--	NC	0.03	1.32E-10
Heptachlor epoxide	9.91E-08	0.01	1.42E-10	--	NC	--	NC	--	NC	0.11	1.09E-09
Lead	NC	74.61	NC	--	NC	--	NC	58.13	NC	--	NC
Pentachlorophenol	1.31E-10	0.99	1.29E-10	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	3.34E-04	0.00024	8.07E-08	--	NC	--	NC	--	NC	0.00100	3.34E-07
Total PCBs	4.18E-09	2.78	1.16E-08	0.49	2.05E-09	0.19	7.80E-10	--	NC	5.40	2.25E-08
TOTAL			9.78E-08		9.17E-09		4.94E-09		4.16E-09		3.62E-07

Notes:

EPC - Exposure Point Concentration.

NC - Not Calculated.

-- - Not a Compound of Potential Concern in this medium.

(a) - Reference risk is multiplied by the EPC in each area to obtain the potential risk.

SAUGET AREA 1 - CREEK BOTTOM SOILS

MLE

NONCARCINOGENIC HAZARD INDEX
INCIDENTAL INGESTION AND DERMAL CONTACT
CREEK BOTTOM SOILS
CONSTRUCTION WORKER - MLE

Constituent	Unit in Soil (mg/kg)	Unit Factor	Oral - Soil Absorption Adjustment	Dermal - Soil Absorption Adjustment	Oral Reference Dose (mg/kg-day)	Chronic Average Daily Dose-Ing. (mg/kg-day)	Chronic Average Daily Dose-Der. (mg/kg-day)	Hazard Index - Ingestion	Hazard Index - Dermal Contact	Unit Hazard Index
1,4-Dichlorobenzene	1.00E+00	1	0.01	3.00E-02	5.01E-08	2.61E-08	1.67E-06	8.71E-07	2.54E-06	
4-Nitroaniline	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Arsenic	1.00E+00	0.3	0.001	3.00E-04	1.50E-08	2.61E-09	5.01E-05	8.71E-06	5.88E-05	
Benzo(a)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(a)pyrene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Benzo(b)fluoranthene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Bis(2-ethylhexyl)phthalate	1.00E+00	1	0.004	2.00E-02	5.01E-08	1.05E-08	2.50E-06	5.23E-07	3.03E-06	
Copper	1.00E+00	1	0.002	3.70E-02	5.01E-08	5.23E-09	1.35E-06	1.41E-07	1.50E-06	
Dibenzo(a,h)anthracene	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Dieldrin	1.00E+00	1	0.01	5.00E-05	5.01E-08	2.61E-08	1.00E-03	5.23E-04	1.52E-03	
Heptachlor	1.00E+00	1	0.01	5.00E-04	5.01E-08	2.61E-08	1.00E-04	5.23E-05	1.52E-04	
Heptachlor epoxide	1.00E+00	1	0.01	1.30E-05	5.01E-08	2.61E-08	3.85E-03	2.01E-03	5.86E-03	
Lead	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Pentachlorophenol	1.00E+00	1	0.01	3.00E-02	5.01E-08	2.61E-08	1.67E-06	8.71E-07	2.54E-06	
2,3,7,8-TCDD TEQ	1.00E+00	NA	NA	NA	NA	NA	NA	NA	NA	NC
Total PCBs	1.00E+00	0.83	0.04	2.00E-05	4.16E-08	1.05E-07	2.08E-03	5.23E-03	7.31E-03	

Noncarcinogenic Assessment - Scaling Table
 Risk by Dermal Contact with and Ingestion of Creek Bottom Soils
 MLE Construction Worker
SAUGET AREA 1 - CREEK BOTTOM SOILS
HUMAN HEALTH RISK ASSESSMENT

Compound	Reference HQ (per mg/kg) (a)	CBS-CSB		CBS-CSD		CBS-CSE		CBS-CSF		SITE M	
		EPC (mg/kg)	HQ								
1,4-Dichlorobenzene	2.54E-06	0.29	7.45E-07	--	NC	--	NC	--	NC	0.98	2.49E-06
4-Nitroaniline	NC	0.76	NC	--	NC	--	NC	--	NC	--	NC
Arsenic	5.88E-05	9.72	5.72E-04	11.40	6.70E-04	8.08	4.75E-04	9.71	5.71E-04	7.28	4.28E-04
Benzo(a)anthracene	NC	0.17	NC	--	NC	--	NC	--	NC	--	NC
Benzo(a)pyrene	NC	0.11	NC	0.08	NC	0.09	NC	0.07	NC	0.21	NC
Benzo(b)fluoranthene	NC	0.16	NC	--	NC	--	NC	--	NC	--	NC
Bis(2-ethylhexyl)phthalate	3.03E-06	1.77	5.35E-06	--	NC	--	NC	--	NC	--	NC
Copper	1.50E-06	484.20	7.24E-04	--	NC	425.21	6.36E-04	--	NC	1437.78	2.15E-03
Dibenzo(a,h)anthracene	NC	0.07	NC	--	NC	0.07	NC	--	NC	0.08	NC
Dieldrin	1.52E-03	0.01	1.18E-05	0.13	1.94E-04	--	NC	--	NC	--	NC
Heptachlor	1.52E-04	--	NC	--	NC	--	NC	--	NC	0.03	4.12E-06
Heptachlor epoxide	5.86E-03	0.01	8.38E-05	--	NC	--	NC	--	NC	0.11	6.45E-04
Pentachlorophenol	2.54E-06	0.99	2.51E-06	--	NC	--	NC	--	NC	--	NC
2,3,7,8-TCDD TEQ	NC	0.00024	NC	--	NC	--	NC	--	NC	0.00100	NC
Total PCBs	7.31E-03	2.78	2.03E-02	0.49	3.59E-03	0.19	1.37E-03	--	NC	5.40	3.95E-02
TOTAL			2.17E-02		4.46E-03		2.48E-03		5.71E-04		4.27E-02

Notes:

EPC - Exposure Point Concentration.

HQ - Hazard Quotient.

NC - Not Calculated.

-- Not a Compound of Potential Concern in this medium.

(a) - Reference HQ is multiplied by the EPC in each area to obtain the area HQ.